Exhibit B

[redacted]

IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

ATLAS GLOBAL TECHNOLOGIES, LLC	§	
	§	
Plaintiff,	§	
	§	**Civil Action No. 2:21-cv-00430-JRG-RSP**
v.	§	
	§	
TP-LINK TECHNOLOGIES CO., LTD., TP-LINK CORPORATION LIMITED, TP-LINK INTERNATIONAL LTD.,	§ § §	**JURY TRIAL DEMANDED**
	§	
Defendants.		

REBUTTAL EXPERT REPORT OF DR. KONSTANTINOS PSOUNIS REGARDING THE VALIDITY OF U.S. PATENT NOS. 9,531,520; 9,532,187; 9,763,259; 9,825,738; 9,912,513; 9,917,679; & 10,020,919

Dated: May 23, 2023

Kostantinos Psounis, Ph.D.

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1. INTRODUCTION

1. I have been retained on behalf of Plaintiff Atlas Global Technologies LLC ("Atlas") to be an independent technical expert in this litigation. Among other things, I have been asked by counsel to opine on the validity of certain claims from U.S. Patent No. 9,531,520 ("the '520 Patent"); U.S. Patent No. 9,532,187 ("the '187 Patent"); U.S. Patent No. 9,763,259 ("the '259 Patent"); U.S. Patent No. 9,825,738 ("the '738 Patent"); U.S. Patent No. 9,912,513 ("the '513 Patent"); U.S. Patent No. 9,917,679 ("the '679 Patent"); and U.S. Patent No. 10,020,919 ("the '919 Patent") (collectively, the "Asserted Patents" or the "Patents-in-Suit"). Specifically, I have been asked by counsel to review the Opening Expert Report of Dr. Christopher J. Hansen on invalidity issues ("Hansen Report"), and to offer rebuttal opinions when I disagree with the opinions expressed in the Hansen Report. Similarly, I have been asked to provide clarifications and more information when I see relevant places where his discussion has been incomplete.

2. The statements made in this expert report are made on my own personal knowledge and opinion, and I can and will testify to the content of this expert report if called on to do so at trial. I reserve the right to supplement or modify my opinions as the lawsuit develops or as new facts or other relevant information are uncovered and to testify in that regard, including testimony in rebuttal to opinions offered by experts representing TP-Link, either prior to or during trial. I also intend to prepare demonstrative exhibits that are consistent with my opinions in this report for use at trial.

3. I am being paid for my work in this litigation at the rate of $700 per hour, plus reimbursement of direct expenses. My compensation does not depend on the outcome of this litigation. I have no other interest in this litigation or the parties thereto.

2. QUALIFICATIONS

4. My education and expertise qualify me to do the below analysis. The details of my education, work experience, research, and publications are summarized in my curriculum

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vitae ("CV") attached hereto as Exhibit A of this report. I provide here a summary of some of the relevant information from my CV as well as other relevant background information.

5. I am a Professor and Associate Chair of Electrical and Computer Engineering and Professor of Computer Science at the University of Southern California. I joined the University of Southern California in 2003, after completing my PhD at Stanford University as a Stanford Graduate Fellow.

6. My professional career has spanned more than 20 years. As set forth in Exhibit A, I have extensive experience in the field of networked distributed systems, including the Internet and the web, Wi-Fi and cellular wireless systems, spectrum sharing wireless systems, sensor and IoT wireless systems, mobile ad hoc and delay tolerant wireless systems, data centers and cloud systems, peer to peer systems, and autonomous vehicles/drones systems.

7. I have published more than 100 technical papers in these fields, which have been cited tens of thousands of times. I have also been awarded numerous grants and significant funding from the government and industry leaders to advance these fields. As a result, I have been named an Institute of Electrical and Electronics Engineers (IEEE) Fellow, the highest grade of membership, for "fundamental contributions in the theory and practice of wireless networks", and a Distinguished Member of the Association of Computing Machinery (ACM).

8. Throughout my career, I have analyzed, designed, and developed efficient networked distributed systems for the Internet and the Web, Wi-Fi and cellular wireless systems, spectrum sharing wireless systems, sensor and IoT wireless systems, mobile ad hoc and delay tolerant wireless networks, data centers and cloud systems, peer to peer systems, and autonomous vehicles/drones systems. As such, I have acquired extensive expertise in the analysis and development of those systems and associated products.

9. I have extensive experience with and made contributions specifically towards analyzing and designing efficient Wi-Fi, cellular and other wireless systems. In particular, I have received multiple funding awards from the National Science Foundation (NSF), the leading

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governmental agency for funding computer engineering and computer science research, to work on wireless systems, including Wi-Fi systems. I have also received multiple funding awards from the industry leaders in the area of networking and in particular wireless networking, to work on these systems. I have published several papers in the most selective academic journals and conferences on wireless systems. I have also been the faculty in charge of the entire networking curriculum at the Electrical and Computer Engineering department at USC for more than a decade and teach networking classes and in particular the graduate wireless networking class yearly.

10. I also have extensive practical experience with networked distributed systems. For example, I was a co-founder of SpaceMUX, Inc. (whose IP was later acquired by Quantenna Communications, Inc.), where I designed and developed systems to increase the speed of wireless networked systems using modern wireless networking technologies and techniques. Also, I was the Technology Architect for Fineground Networks (later acquired by Cisco Systems, Inc.), where I designed and developed systems to accelerate the delivery of content over the World Wide Web. In addition, for over 20 years both at Stanford University and at the University of Southern California I have designed and implemented efficient algorithms, protocols and systems for a variety of distributed networked systems, and I have consulted for industrial leaders, and produced prototype systems. I have also applied for and been granted numerous patents, which are owned by network industry leaders and prestigious academic institutions.

11. In sum, I have extensive experience in and familiarity with the fields of networked distributed systems and in particular with wireless networking systems including Wi-Fi systems, and extensive experience and contributions towards the analysis, design and implementation of such systems.

3. MATERIALS REVIEWED AND RELIED UPON

12. In forming the opinions set forth in this expert report, I have reviewed a number of materials. A list of the documents that I have reviewed and relied upon for this report is

[redacted]

attached as Exhibit B (as well as those cited in the body of this report). I have also relied on my education, experience, and knowledge of computer science and engineering, as well as my understanding of the applicable legal principles.

13. I have also generally reviewed certain aspects of the expert report of Dr. Matthew Shoemake on infringement issues—at least those sections relating to the summaries of the Asserted Patents, their prosecution histories, and their priority dates. I generally agree with those sections of Dr. Shoemake's report and, so as not to "reinvent the wheel," have incorporated certain portions in this report.

14. I also submitted three declarations in related cases brought by Atlas involving many of the same Asserted Patents: (1) *Sercomm Corp. v. Atlas Global Technologies, LLC*, IPR2022-01519 (re validity of the '513 Patent); (2) *Sercomm Corp. v. Atlas Global Technologies, LLC*, IPR2022-01520 (re validity of the '919 Patent); and (3) *Atlas Global Technologies, LLC v. OnePlus Technology (Shenzhen) Co., Ltd.*, Case No. 6:21-cv-1217-ADA (W.D. Tex.) (re claim construction of the '259, '738, '442, '513, '679, '919, '886, and '851 Patents). Where appropriate, I incorporate those declarations herein.

4. SUMMARY OF OPINIONS

15. I have been asked to opine on Dr. Hansen's expert report and validity of the Asserted Patents. Based on my study to date and as set forth in detail below, I have concluded that the Asserted Patents are not invalid. More specifically, none of the alleged prior art identified by Dr. Hansen discloses or renders obvious each and every element of the claims of the asserted patents. Further, I have concluded that a person of ordinary skill in the art would not have combined the alleged prior art in the manner proposed by Dr. Hansen. In my opinion, all Asserted Claims of the Asserted Patents are valid.

5. LEGAL STANDARDS

16. I am not an attorney. I have been advised of the following general principles of patent law to be considered in formulating my opinions as to the validity of the Patents-in-Suit. I have applied these principles to the facts set forth in this report in rendering my opinions.

[redacted]

5.1 Claim Interpretation

17. I understand that claims are to be interpreted from the perspective of one of ordinary skill in the art at the time of the invention and have considered such an interpretation in forming my opinions on validity. I also understand that claim construction is a matter of law and that claims are to be construed by the Court.

18. It is my understanding that the claims of the patent are construed consistent with the so-called intrinsic evidence, which includes the language of the claim itself, the specification of the patents, other claims of the patent and the relevant prosecution histories from the U.S. Patent and Trademark Office ("USPTO"). Other materials (such as dictionaries) not in the written records of the patents, *i.e.*, extrinsic evidence, may also be considered if they are consistent with (not contradictory to) the intrinsic evidence.

19. The Court's Claim Construction Order issued on February 8, 2023 in the current litigation. In this expert report, I have used the Court's Claim Construction Order to address the validity issues. The Court's Claim Construction Order construes the claim terms as follows, and I have adopted those constructions in my validity analysis:

Claim Term	Court's Construction
'520 Patent	
"the downlink multi-user frame including a plurality of resource units (RUs)" ('520 Patent, Claim 1)	Plain meaning
"including a respective set of MAC Protocol Data Units (MPDUs) in each RU of the plurality of RUs" ('520 Patent, Claim 1)	Plain meaning
"wherein the first MPDU is located in a first resource unit of the downlink multi-user frame allocated to the first station, wherein the downlink multi-user frame includes a second resource unit that contains a second MPDU that includes acknowledgement information for the second multi-user acknowledgement frame" ('520 Patent, Claim 9)	Plain meaning

[redacted]

Claim Term	Court's Construction
"network device" ('520 Patent, Claims 1, 6)	Plain meaning
'259 Patent	
"wherein the NDPA frame indicates information corresponding to the predetermined length" ('259 Patent, Claim 6)	Plain meaning
'738 Patent	
"wherein the second information is a function of a total number of space time streams to be used to transmit the multiple uplink frames" ('738 Patent, Claim 1)	Plain meaning
"wherein the second information is a function of a total number of space time streams to be used to perform the simultaneous transmission of the uplink frame and the one or more uplink frames from the one or more other stations" ('738 Patent, Claim 9)	Plain meaning
"uplink setup information" ('738 Patent, Claims 1, 9)	Plain meaning
"wherein the acknowledgement frame includes acknowledgement information for one or more of the plurality of stations" ('738 Patent, Claim 6)	Plain meaning
"wherein the acknowledgement frame includes acknowledgement information for the station and one or more other stations of the plurality of stations" ('738 Patent, Claim 14)	Plain meaning
'513 Patent	
"wherein at least a portion of the payload of the uplink frame is associated with the first guard interval length" ('513 Patent, Claim 1)	"wherein some or all of the payload of the uplink frame uses the first guard interval length"
"wherein at least a portion of the payload of the uplink frame is associated with the first CP length" ('513 Patent, Claim 9)	"wherein some or all of the payload of the uplink frame uses the first CP length"
"wherein at least a portion of the legacy header is associated with a second CP length" ('513 Patent, Claim 10)	"wherein some or all of the legacy header uses a second CP length"

[redacted]

Claim Term	Court's Construction
"wherein at least a portion of the respective non-legacy header is associated with the first guard interval" ('513 Patent, Claim 16)	"wherein some or all of the respective nonlegacy header uses the first guard interval"
"based on the resources for the UL MU transmission" ('513 Patent, Claim 15)	"based on the resources for the UL MU transmission" modifies the "plurality of frames from the set of stations."
'679 Patent	
"single-user (SU) format" / "SU format" ('679 Patent, Claims 1, 6)	Plain meaning
"multiple-user (MU) format" / "MU format" ('679 Patent, Claims 1, 6)	Plain meaning
'919 Patent	
"in response to determining that the number of the one or more station information fields in the NDPA is one" ('919 Patent, Claim 1)	Plain meaning
"when a number of the one or more station information fields in the NDPA is one" ('919 Patent, Claim 11)	Plain meaning
"when the number of the one or more station information fields in the NDPA is greater than one" ('919 Patent, Claims 2, 8, 12, 19)	Plain meaning
"cardinality" ('919 Patent, Claims 1, 11)	Plain meaning
"wherein the number of the one or more station information fields in the NDPA is the cardinality of the one or more station information fields in the NDPA" ('919 Patent, Claim 1)	Plain meaning
"wherein the number of the one or more station information fields in the NDPA is exactly the cardinality of the one or more station information fields in the NDPA" ('919 Patent, Claim 11)	Plain meaning

20. For those terms that the Court did not construe, my assessment and determination of validity is informed by the plain and ordinary meaning these terms would have to one of ordinary skill in the art at the time of the invention deemed to have read the claim term in the context of the particular claim as well as the entire patent, including the specification.

[redacted]

5.2 Presumption of Validity and Burden of Proving Invalidity

21. I understand that a patent is presumed valid. I understand that the basis for that presumption of validity is the fact that allowed claims have passed through a rigorous examination process at the U.S. Patent Office. The evidence to overcome the presumption of validity must be "clear and convincing." Thus, in order to invalidate any claim of the Patents-in-Suit, I understand that TP-Link must set forth clear and convincing evidence that places an "abiding conviction" in the mind of the jury that the facts it relies upon to prove invalidity are "highly probable."

5.3 Anticipation

22. It is my understanding that anticipation under 35 U.S.C. section 102 requires that a single prior art reference or product clearly and convincingly discloses or contains, expressly or inherently, every limitation of the claimed invention. Relevant standards for anticipation (from 35 U.S.C. § 102, post-AIA) are reproduced below:

> (a) Novelty; Prior Art.—A person shall be entitled to a patent unless—
>
> (1) the claimed invention was patented, described in a printed publication, or in public use, on sale, or otherwise available to the public before the effective filing date of the claimed invention; or
>
> (2) the claimed invention was described in a patent issued under section 151, or in an application for patent published or deemed published under section 122(b), in which the patent or application, as the case may be, names another inventor and was effectively filed before the effective filing date of the claimed invention.
>
> * * * * *
>
> (d) Patents and Published Applications Effective as Prior Art.—For purposes of determining whether a patent or application for patent is prior art to a claimed invention under subsection (a)(2), such patent or application shall be considered to have been effectively filed, with respect to any subject matter described in the patent or application—
>
> (1) if paragraph (2) does not apply, as of the actual filing date of the patent or the application for patent; or
>
> (2) if the patent or application for patent is entitled to claim a right of priority under section 119, 365(a), 365(b), 386(a), or 386(b), or to claim the benefit of an earlier filing date under section 120, 121, 365(c), or 386(c), based upon 1 or more prior filed applications for patent, as of the filing date of the earliest such application that describes the subject matter.

[redacted]

23. I understand that, in general, the anticipation analysis under 35 U.S.C. § 102 is limited to the use of a single reference. I further understand that portions of additional documents may be relied upon as part of the anticipation analysis if the primary reference incorporates the additional documents by reference. In order for the primary reference to incorporate additional documents by reference, the primary reference must identify with detailed particularity what specific material it incorporates and clearly indicate where that material is found in the additional documents. A mere reference to another document is insufficient to incorporate that document by reference. Moreover, the referenced document must, itself, be publicly available to be properly incorporated by reference.

24. I understand that the phrase "printed publication" as used in § 102(a) means sufficiently accessible to the public interested in the art and depends upon dissemination and accessibility. Even a document that has been distributed is not necessarily a printed publication if, for example, distribution is governed by a binding agreement of confidentiality.

5.4 Obviousness

25. It is my understanding that a claim is invalid for obviousness under 35 U.S.C. § 103 if, for example, two or more prior art references in combination clearly and convincingly disclose, expressly or inherently, every claim limitation so to render the claim, as a whole, obvious. The relevant standard for obviousness (from 35 U.S.C. §103, pre-AIA) is as follows:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

26. In determining whether or not a patented invention would have been obvious, the following factors must be considered: (a) the scope and content of the prior art; (b) the differences

[redacted]

between the prior art and the claims at issue; (c) the level of ordinary skill in the art; and (d) whatever "secondary considerations" may be present.

27. I understand that certain "secondary considerations" may be relevant in determining whether or not an invention would have been obvious, and that these secondary considerations may include commercial success of a product using the invention, if that commercial success is due to the invention; long-felt need for the invention; evidence of copying of the claimed invention; industry acceptance; initial skepticism; failure of others; praise of the invention; and the taking of licenses under the patents by others. And any evidence of secondary considerations must be considered as part of the obviousness analysis.

28. I understand that a patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art. Most, if not all, inventions rely on building blocks of prior art. But multiple prior art references or elements may, in some circumstances, be combined to render a patent claim obvious. I understand that I should consider whether there is an "apparent reason" to combine the prior art references or elements in the way the patent claims. To determine whether such an "apparent reason" to combine the prior art references or elements in the way a patent claims, it will often be necessary to look to the interrelated teaching of multiple patents, to the effects of demands known to the design community or present in the marketplace, and to the background knowledge possessed by a person having ordinary skill in the art. Further, one must consider the prior art as a whole—not just cherry-picking certain disclosures from a prior art reference and ignoring other prior art references or other disclosures from the same prior art references. In this case, TP-Link has the burden to prove by clear and convincing evidence that, at the time of the claimed invention, there was an apparent reason that would have prompted a person having ordinary skill in the field of the invention to combine the known elements and references in the way the claimed invention does.

[redacted]

29. I also understand that there are restrictions in applying "common sense" to an obviousness analysis. First, I understand that common sense could, in limited circumstances, be invoked to provide a known motivation to combine, not to supply a missing claim limitation. I also understand that reliance on "common sense" cannot be used as a substitute for actual evidence and analysis.

30. I also understand that when the prior art "teaches away" from combining prior art references or certain known elements, discovery of a successful means of combining them is more likely to be non-obvious. A prior art reference may be said to "teach away" from a patent when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the patent or would be led in a direction divergent from the path that was taken by the patent. Additionally, a prior art reference may "teach away" from a claimed invention when substituting an element within that prior art reference for a claim element would render the claimed invention inoperable.

31. I also understand that it is not permissible to use hindsight in assessing whether a claimed invention is obvious. Rather, I understand that, to assess obviousness, you must place yourself in the shoes of a person having ordinary skill in the relevant field of technology at the time the inventions were made who is trying to address the issues or solve the problems faced by the inventor and ignore the knowledge you currently now have of the inventions. The prior art itself, and not the inventor's achievements, must establish any obviousness. Further, I understand that defining the problem to be solved in terms of its solution reveals improper hindsight in the selection of the prior art relevant to obviousness. Further, an overly narrow statement of the problem can represent a form of hindsight, because often the inventive contribution lies in defining the problem in a new revelatory way. Similarly, an assertion that a person of ordinary skill could combine the references, rather than that they would have been motivated to do so, is an impermissible form of hindsight. Moreover, knowledge of a problem and motivation to solve it are entirely different from motivation to combine particular references to reach the particular claimed method.

[redacted]

5.5 Priority Dates

32. I also understand that a later-filed patent may be entitled to the earlier priority date of a provisional application to which it claims priority if that provisional application provides support for both (1) the disclosures in the later-filed patent and (2) at least one claim of the later-filed patent. I also understand that the party seeking the benefit of the earlier priority date bears the burden to prove (1) and (2).

5.6 Written Description

33. I understand that a patent claim satisfies the written description requirement if it reasonably conveys to those skilled in the art that the inventor had possession of the claimed invention as of the filing date. I further understand that the inquiry to determine whether a claim satisfies the "written description" requirement is performed from the viewpoint of a person having ordinary skill in the field of technology of the patent when the application was filed. This written description requirement may be satisfied by any combination of the words, structures, figures, diagrams, formulas, etc., contained in the patent application. The level of detail required to satisfy the written description requirement varies depending on the nature and scope of the claims and on the complexity and predictability of the relevant technology. The written description requirement does not demand specific examples to be disclosed in the specification. Failure to satisfy the written description requirement must be shown by clear and convincing evidence.

5.7 Person of Ordinary Skill in the Art

34. To determine a person of ordinary skill in the art ("POSITA"), I understand one must consider at least the following criteria: (a) the type of problems encountered in the art; (b) prior art solutions to those problems; (c) the rapidity with which innovations are made; (d) the sophistication of the technology; and (e) the education level of active workers in the field. In my opinion, a person of ordinary skill in the art of the Asserted Patents would have (a) at least an undergraduate degree in electrical engineering, computer science, or computer engineering, or an equivalent field; (b) knowledge of the IEEE 802.11 standard

[redacted]

including its MAC and PHY protocols; and (c) at least two years' experience in the development of wireless local area networks (WLANs). This description is approximate, and a higher level of education or skill might make up for less experience, and vice-versa.

35. Dr. Hansen similarly opines that a POSITA "would have head at least a B.S. degree in electrical engineering or a related field such as computer engineering, would have had knowledge of the IEEE 802.11 standards including MAC and PHY protocols, and would have had at least two years of experience in the development of wireless local area networks ("WLANs"). A higher level of education or skill may make up for less experience, and vice-versa." Hansen Report at ¶14.

36. I am at least one of ordinary skill in the art under any reasonable definition, including my and Dr. Hansen's definition (which are roughly the same). My opinions would not change using either my or Dr. Hansen's definition of a person of ordinary skill.

6. IEEE STANDARDS

37. In this section, I address Dr. Hansen's allegations regarding IEEE 802.11. *See* Hansen Report at ¶¶60-125.

38. I agree with Dr. Hansen (at ¶61) that IEEE 802.11ax (a/k/a "Wi-Fi 6") was released in 2021. https://standards.ieee.org/ieee/802.11ax/7180/. I also agree (at ¶61) that 802.11ax increased overall data throughput, as well as permitted simultaneous multi-user communication in both uplink and downlink directions. *See* https://www.tp-link.com/us/wifi6/. I also agree (at ¶61) that 802.11ax provided numerous features to enable operation in crowded environments while reducing the power consumption of compliant devices. *Id.*

39. I agree with Dr. Hansen (at ¶62) that work on IEEE 802.11ax began in early 2013, and the project authorization request was adopted on March 27, 2014. https://www.ieee802.org/11/Reports/tgax_update.htm. I also agree (at ¶63) that the document 802.11-014/0938, titled "802.11 ax Selection Procedure," generally explains the process by which the 802.11ax task group would develop the 802.11ax standard.

[redacted]

https://mentor.ieee.org/802.11/dcn/14/11-14-0938-04-00ax-802-11ax-selection-procedure.doc.

40. Regarding the ‘520 Patent, I generally agree with Dr. Hansen (at ¶¶64-65) that 802.11ac provided DL MU communications (*e.g.*, DL MU-MIMO), but not UL MU communications (*e.g.*, UL MU-MIMO or UL OFDMA). However, I disagree with Dr. Hansen (at ¶¶65-66) that it was obvious to employ UL MU communication in 802.11ax for simultaneous acknowledgments from STAs like in the ‘520 Patent, or that the multi-user uplink acknowledgment technology claimed by the ‘520 Patent was invented by others before the priority date of the ‘520 Patent. *See* below.

41. Regarding the ‘187 Patent, I generally agree with Dr. Hansen (at ¶¶67-68) that interleaving is used in wireless communications to mitigate the effects of channel fading and that interleaving was used in prior versions of 802.11. However, I disagree with Dr. Hansen (at ¶¶68-69) that it was obvious to use interleaver techniques for subchannels or resource units for simultaneous OFDMA transmission like in the ‘187 Patent, or that the interleaver technology claimed by the ‘187 Patent was invented by others before the priority date of the ‘187 Patent. *See* below.

42. Regarding the ‘259 Patent, I generally agree with Dr. Hansen (at ¶¶70-71) that channel sounding permits devices to better understand radio transmission characteristics and can be used to compute beamforming vectors—including in 802.11ac. However, I disagree with Dr. Hansen (at ¶¶71-72) that it was obvious to use the particular channel sounding techniques claimed by the ‘259 Patent with 802.11ax, or that the channel sounding technology claimed by the ‘259 Patent was invented by others before the priority date of the ‘259 Patent. *See* below.

43. Regarding the ‘738 Patent, I generally agree with Dr. Hansen (at ¶¶73-74) that the basic notion of acknowledging received packets was used in prior 802.11 standards, and that block acknowledgments for multiple received packets was introduced in 802.11e-2005. https://standards.ieee.org/ieee/802.11e/3131/. However, I disagree with Dr. Hansen (at

[redacted]

¶¶74-75) that it was obvious to use the particular packet acknowledgment techniques claimed by the ‘738 Patent with 802.11ax, or that the packet acknowledgment technology claimed by the ‘738 Patent was invented by others before the priority date of the ‘738 Patent. *See* below.

44. Regarding the ‘513 Patent, I generally agree with Dr. Hansen (at ¶¶76-77) that MU UL transmissions (*e.g.*, UL OFDMA) need to be synchronized, and that UL OFDMA was new for 802.11ax. However, I disagree with Dr. Hansen (at ¶¶77-78) that it was obvious to use the particular synchronization techniques claimed by the ‘513 Patent with 802.11ax UL OFDMA transmissions, or that the synchronization technology claimed by the ‘513 Patent was invented by others before the priority date of the ‘513 Patent. *See* below.

45. Regarding the ‘679 Patent, I generally agree with Dr. Hansen (at ¶¶79-80) that 802.11 protocols normally require acknowledgments and that 802.11ax first provided UL MU transmissions. However, I disagree with Dr. Hansen (at ¶¶80-81) that it was obvious to use the particular acknowledgment techniques claimed by the ‘679 Patent with 802.11ax UL MU transmissions, or that the packet acknowledgment technology claimed by the ‘679 Patent was invented by others before the priority date of the ‘679 Patent. *See* below.

46. Regarding the ‘919 Patent, I generally agree with Dr. Hansen (at ¶¶82-83) that channel sounding permits 802.11 devices to determine channel state information, which can be used to efficiently allocate resources. However, I disagree with Dr. Hansen (at ¶¶83-84) that it was obvious to use the particular channel sounding techniques claimed by the ‘919 Patent with 802.11ax, or that the channel sounding technology claimed by the ‘919 Patent was invented by others before the priority date of the ‘919 Patent. *See* below.

47. Dr. Hansen notes that various persons associated with his “state of the art” references authored technical documents submitted to the 802.11ax Task Group. *E.g.*, Hansen Report at ¶91 (Simone Merlin made 16 technical submissions); *id.* at ¶96 (Sameer Vermani authored several technical submissions); *id.* at ¶100 (Jinyoung Chun authored 4 technical submissions); *id.* at ¶109 (Liwen Chu authored about 100 technical submissions). To the

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extent this is relevant, I note that Newracom inventors authored hundreds of technical documents submitted to the TGax. *See* https://mentor.ieee.org/802.11/documents?is_dcn=Newracom&is_group=00ax (showing more than 300 TGax technical submissions authored by Newracom employees); https://www.ieee802.org/11/Reports/tgax_update.htm (showing 159 technical submissions authored by Newracom employees). I also note that TP-Link employees contributed zero technical submissions to TGax. *See* https://mentor.ieee.org/802.11/documents?is_dcn=TP-Link&is_group=00ax; https://www.ieee802.org/11/Reports/tgax_update.htm.

7. OVERARCHING COMMENT ON DR. HANSEN'S INVALIDITY ANALYSIS

48. Dr. Hansen's invalidity report provides no analysis or explanation as to how the alleged prior art supposedly maps to the Asserted Claims. Instead, Dr. Hansen summarily concludes that a reference "discloses this element" and then quotes various lengthy passages from that reference. Dr. Hansen uses no bolding, color coding, highlighting or any other emphasis to indicate how those lengthy passages correspond to the claim language. Nor does Dr. Hansen apply (or even mention) the Court's claim constructions in his analysis. It appears the entirety of Dr. Hansen's invalidity report consists of nothing more than reproducing TP-Link's invalidity contentions in "report form."

49. For example, with respect to '513 claim 1[d], Dr. Hansen merely states "Choi discloses this element" and then block quotes paragraphs [0113]-[0114], [0115]-[0119], [0120]-[0124], [0121]-[0125] and Fig. 10—without any further explanation or emphasis to indicate how those lengthy passages correspond to the claim language. Hansen Report at ¶¶2563-2585. Dr. Hansen never applies or even mentions the Court's explicit construction of '513 claim 1[d]—namely, "wherein some or all of the payload of the uplink frame uses the first guard interval length." *Id.* And the passages from Choi that Dr. Hansen block quotes for '513 claim 1[d] are the same passages found in TP-Link's invalidity contentions, thereby suggesting he did nothing more than copy-paste the invalidity contentions into his

[redacted]

report. *See* TP-Link 7/13/22 Invalidity Contentions at Exhibit 513_Jinsoo, pp. 30-34 (block quoting Choi paragraphs [0113]-[0114], [0115]-[0119], [0120]-[0124], [0121]-[0125] and Fig. 10).

50. Also for example, with respect to '679 claim 1[a], Dr. Hansen merely states "Merlin '690 discloses this element" and then block quotes paragraphs [0125]-[0138], [0180]-[0181], [0185], and [0115]—without any further explanation or emphasis to indicate how those lengthy passages correspond to the claim language. Hansen Report at ¶¶3015-3022. And the passages from Merlin '690 that Dr. Hansen block quotes for '679 claim 1[a] are the same passages found in TP-Link's invalidity contentions, thereby suggesting he did nothing more than copy-paste the invalidity contentions into his report. *See* TP-Link 7/13/22 Invalidity Contentions at Exhibit 679_Merlin 690, pp. 8-14 (block quoting Merlin '690 at paragraphs [0125]-[0138], [0180]-[0181], and [0185]).

51. Also for example, with respect to '259 claim 1[pre], Dr. Hansen merely states "Chun discloses this element" and then block quotes the abstract and paragraphs [0002], [0008]-[0009], [0070], [0131], [0141], [0151], and Figs 4, 8-10 of Chun—without any further explanation or emphasis to indicate how those lengthy passages correspond to the claim language. Hansen Report at ¶¶1565-1568. And the passages from Chun that Dr. Hansen block quotes for '259 claim 1[pre] are the same passages found in TP-Link's invalidity contentions, thereby suggesting he did nothing more than copy-paste the invalidity contentions into his report. *See* TP-Link 7/13/22 Invalidity Contentions at Exhibit 259_Chun, pp. 3-8 (block quoting Chun at the abstract and paragraphs [0002], [0008]-[0009], [0070], [0131], [0141], [0151], and Figs 4, 8-10 of Chun).

52. These are mere exemplars, and the same is true of virtually every part of Dr. Hansen's prior art "analysis." This complete lack of meaningful analysis leads to the inevitable conclusion that Dr. Hansen has not met his burden to prove invalidity by clear and convincing evidence.

[redacted]

8. THE ART REFERENCED IN THE HANSEN REPORT DOES NOT INVALIDATE THE ASSERTED CLAIMS OF THE ’520 PATENT

8.1 Overview of the ’520 Patent

53. The ’520 Patent is titled “Apparatus and Method for Downlink and Uplink Multi-User Transmissions.” ’520 Patent (ATLAS-00000001-33) at Title Page. It was invented by Young Hoon Kwon and Ahmad Reza Hedayat while working on the next-generation IEEE 802.11ax standard (aka Wi-Fi 6) at Newracom. *Id.*; *see also id.* at 6:57-60, 13:25-27. The ’520 Patent claims priority to March 23, 2015 and March 30, 2015. *Id.* It issued on December 27, 2016. *Id.*

54. The ’520 Patent generally relates to methods for sending and receiving multi-user triggering frames that solicit a multi-user acknowledgement transmission and include acknowledgement information indicating properties of the multi-user acknowledgement transmission.

55. By way of example, the embodiments corresponding to Figures 7A and 7B describe a process whereby the AP coordinates simultaneous UL MU acknowledgement/response transmissions to a DL MU transmission. *See, e.g.*, ’520 Pat. at 19:50-21:51. The flowchart of Figure 7A summarizes the steps of the process:

[redacted]

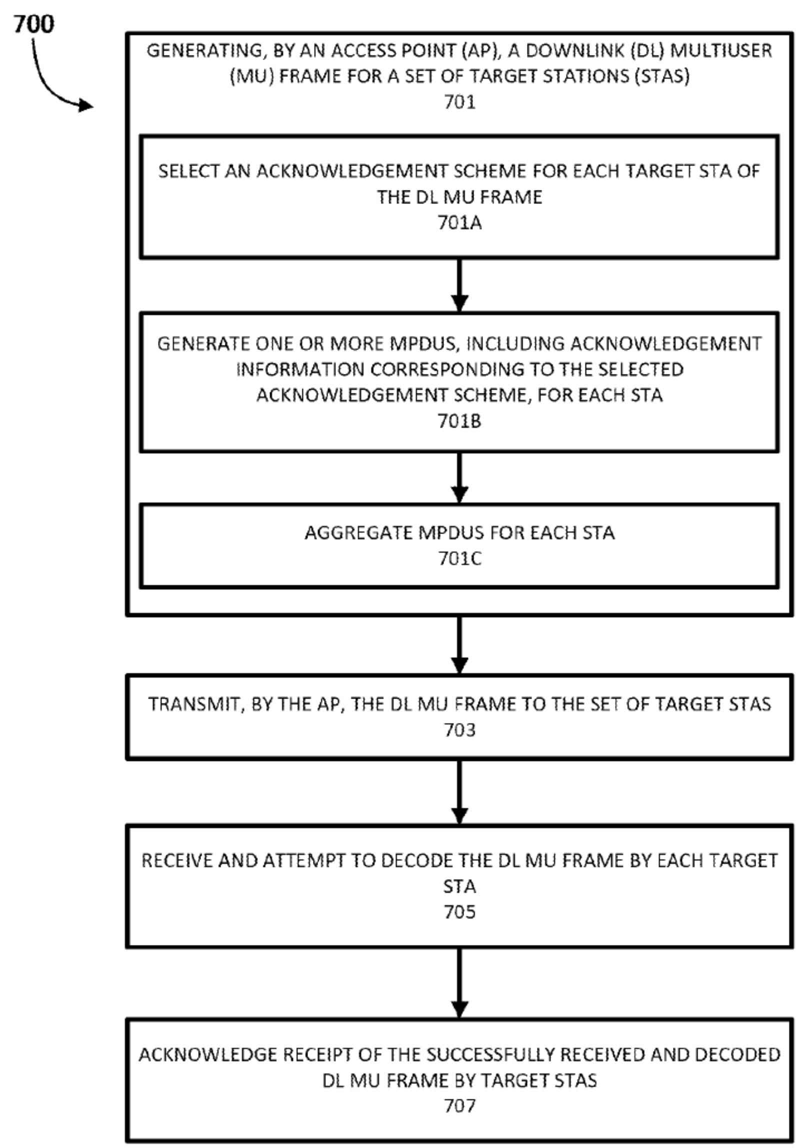


FIG. 7A

’520 Pat. at Fig. 7A.

56. In the Figure 7 embodiments, the transmitting device, such as an AP, generates a DL MU frame. ’520 Pat. at 19:58-20:6. The DL MU frame may be addressed to multiple STAs operating in the network and each STA is allocated separate resources within the DL MU frame. *Id.* at 20:6-18. In this example, there are two STAs denoted “STA1” and “STA2”

[redacted]

and STA1 is allocated a first RU (a lower half of the transmission bandwidth) while STA2 is allocated a second RU (an upper half of the transmission bandwidth). *Id.*

57. The AP selects an acknowledgement scheme for the target STAs and determines properties or characteristics of the acknowledgement such as "(1) whether the acknowledgement is immediate or non-immediate, (2) whether the acknowledgement is s multi-user or single user, and/or (3) scheduling information (e.g., a resource unit within a UL transmission) when a multi-user acknowledgement is selected." *Id.* at 20:19-28.

58. Following selection of the acknowledgement scheme, the AP generates MPDUs and places each MPDU in a RU of the DL MU frame. *Id.* at 20:44-48. The RUs may be particular spatial streams or sub-channels of a wireless channel upon which the DL MU frame will be transmitted; in the example embodiment of Figure 7, the RUs are sub-channels. *Id.* at 20:48-50. The MPDUs includes information indicating the properties of the acknowledgment scheme selected for each STA. *Id.* at 20:51-65. Following generation of the DL MU frame and its contents, the DL MU frame is transmitted to the target STAs. *Id.* at 21:17-24.

59. Next, the target STAs receive and decode the DL MU frame, checking the headers of one or more MPDUs to determine the properties of the acknowledgment scheme selected for that STA. *Id.* at 21:25-36. If the DL MU frame is successfully received and decoded, the STA may generate and transmit a UL acknowledgement frame according to the acknowledgement information extracted from the DL MU frame. *Id.* at 21:37-51. In particular, if indicated by the acknowledgement information, STA1 and STA2 may simultaneously send UL acknowledgement transmissions after a time period, such as a SIFS, where each STA uses a different RU or set of RUs (*e.g.*, each of the plurality of simultaneous uplink transmissions uses a sub-channel, spatial stream, or sub-channel and spatial stream combination that is not used by any other of the plurality of simultaneous uplink transmissions). *Id.* This is further illustrated in Figure 7B:

[redacted]

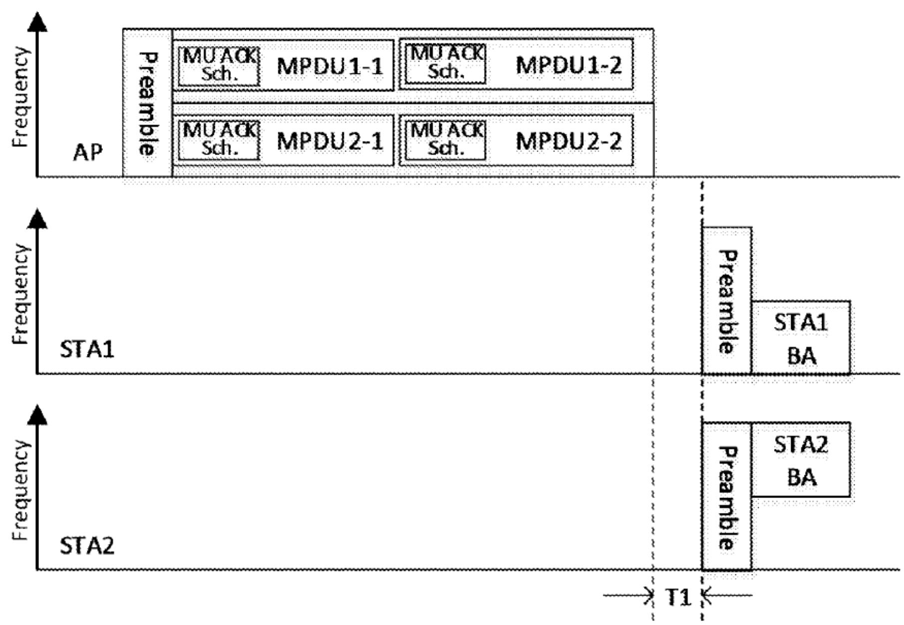


FIG. 7B

’520 Pat. at Fig. 7B.

60. Thus, the ’520 Patent teaches the use of DL MU triggering frames to synchronize and schedule uplink OFDMA and MU-MIMO, thereby using network resources more efficiently. By embedding scheduling information in resource units of a downlink multi-user transmission, the access point specifies timing and resource allocations for the corresponding uplink multi-user response.

8.2 ’520 Priority Date

61. The ’520 Patent claims priority to provisional application no. 62/137,138, filed on March 23, 2015 (the “First ‘520 Provisional”), and provisional application no. 62/140,349, filed on March 30, 2015 (the “Second ‘520 Provisional”):

Related U.S. Application Data

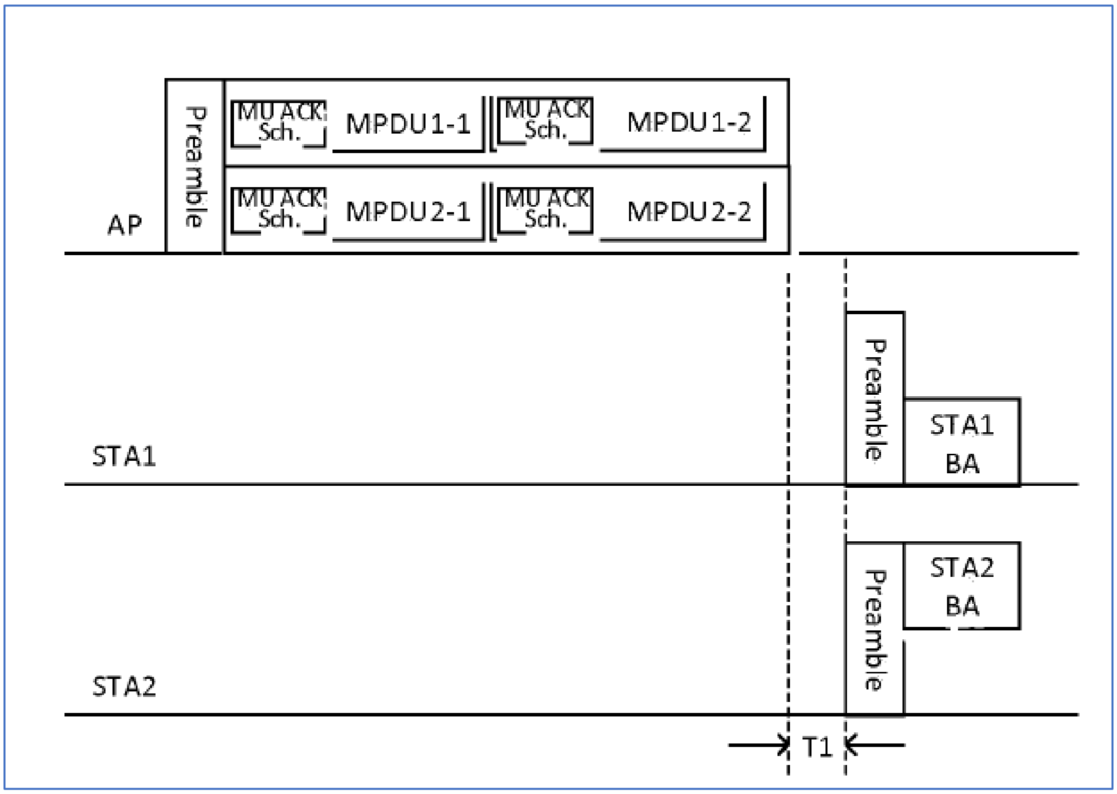
(60) Provisional application No. 62/137,138, filed on Mar. 23, 2015, provisional application No. 62/140,349, filed on Mar. 30, 2015.

ATLAS-00000002.

[redacted]

8.2.1 The First ’520 Provisional

62. The First ’520 Provisional (ATLAS-00004101-4131) is titled “Apparatus and Methods for Downlink Multi-User Transmission.” It describes “several mechanisms that enable transmission of acknowledgement frames in UL MU manner.” *Id.* at 8. Among the mechanisms described is a procedure that corresponds to the Figure 7 embodiment discussed above; the First ’520 Provisional even includes a copy of Figure 7B:



Id. at 13.

63. As described in the First ’520 Provisional, “In the third approach of the invention, each per-STA encoding block of DL MU PPDU comprises a scheduling information for UL MU acknowledgement frame transmission. For this purpose, the MAC header part within DL A-MPDU for each STA participating immediate MU acknowledgement frame transmission includes indication of the UL resource allocation information for immediate MU acknowledgement transmission. As legacy STA cannot participate UL MU acknowledgement, legacy STAs will be assigned for delayed acknowledgement, while new

[redacted]

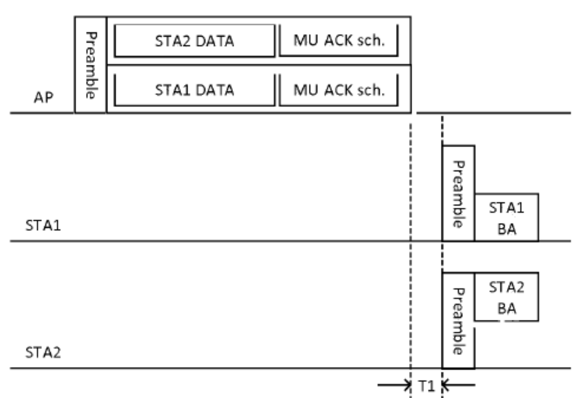
STAs can be assigned to immediate MU acknowledgement." *Id.* at 12. "Ack Policy subfield in the QoS Control field of DM MU PPDU for all STAs scheduled for immediate MU acknowledgement is set to immediate acknowledgement to further indicate immediate acknowledgement." *Id.*

64. The First '520 Provisional then describes how this is illustrated in the figure reproduced above: "The illustration below shows an example frame exchange using this approach. In this example, an AP schedules STA1 and STA2 for DL OFDMA transmission, wherein STA1 is allocated in the lower half of the transmission bandwidth and STA2 is allocated in the upper half of the transmission bandwidth. In this example, the AP's DL MU PPDU comprises two independent AMPDUs, wherein the first AMPDU is targeted to STA1 and the second AMPDU is targeted to STA2. And, MAC header part in every MPDU within the AMPDU comprises UL MU acknowledgement scheduling information. The UL MU acknowledgement scheduling information indicates the resource allocation information for each STA's UL MU acknowledgement frame transmission, which follows predetermined time after receiving DL MU PPDU." *Id.* at 12-13.

65. It is my opinion that the First '520 Provisional provides support for the'520 claims. I provide examples below of statements in the First '520 Provisional that provide written description support for asserted claims:

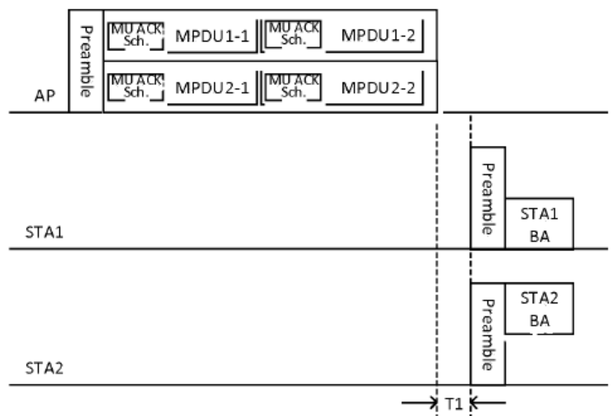
Claim 1	**First '520 Provisional**
1[A]. A method, implemented by a network device in a wireless network, for coordinating an uplink multi-user response transmission to a downlink multiuser transmission, the method comprising:	"In the second approach of the invention, each per-STA encoding block of DL MU PPDU comprises a scheduling information for UL MU acknowledgement frame transmission." *Id.* at 11. "Each target receiver of DL MU PPDU receives the DL MU PPDU and checks the Preamble part of the frame, wherein the Preamble part indicates the allocated resource for each target receiver. Then, the target receiver decodes the PPDU that is allocated to the receiver and then can identify in which resource the receiver is allowed to send the

[redacted]

	UL acknowledgement frame. In a predetermined time after receiving the DL MU PPDU, the receiver sends UL acknowledgement frame in MU fashion, following the resource allocation that is given in the MU acknowledgement scheduling part of the received PPDU." *Id.* at 11.
[1B] generating, by the network device, a downlink multi-user frame addressed to a plurality of stations operating in the wireless network, the downlink multi-user frame including a plurality of resource units (RUs), wherein generating the downlink multi-user frame comprises:	"In this example, an AP schedules STA1 and STA2 for DL OFDMA transmission, wherein STA1 is allocated in the lower half of the transmission bandwidth and STA2 is allocated in the upper half of the transmission bandwidth. In this example, the AP's DL MU PPDU comprises two independent AMPDUs, wherein the first AMPDU is targeted to STA1 and the second AMPDU is targeted to STA2. And, each of AMPDU comprises an MPDU which includes UL MU acknowledgement scheduling information. The UL MU acknowledgement scheduling information indicates the resource allocation information for each STA's UL MU acknowledgement frame transmission, which follows predetermined time after receiving DL MU PPDU." *Id.* at 11. "Each target receiver of DL MU PPDU receives the DL MU PPDU and checks the Preamble part of the frame, wherein the Preamble part indicates the allocated resource for each target receiver." *Id.* at 11.  *Id.* at 12. "In this example, an AP schedules STA1 and STA2 for DL OFDMA transmission, wherein

[redacted]

STA1 is allocated in the lower half of the transmission bandwidth and STA2 is allocated in the upper half of the transmission bandwidth. In this example, the AP's DL MU PPDU comprises two independent AMPDUs, wherein the first AMPDU is targeted to STA1 and the second AMPDU is targeted to STA2. And, MAC header part in every MPDU within the AMPDU comprises UL MU acknowledgement scheduling information. The UL MU acknowledgement scheduling information indicates the resource allocation information for each STA's UL MU acknowledgement frame transmission, which follows predetermined time after receiving DL MU PPDU." *Id.* at 12-13.

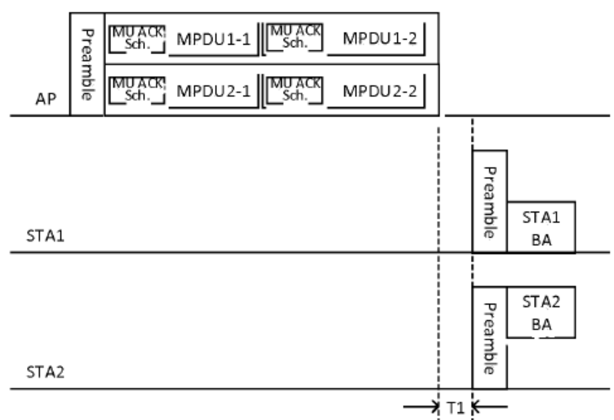


Id. at 13.

"Downlink (DL) multi-user (MU) multiple-input-multiple-output (MIMO) procedure that is defined in IEEE 802.11ac specification is illustrated in the drawings below." *Id.* at 6.

"IEEE 802.11 standard further includes the concept of uplink multi-user simultaneous transmission, such as UL orthogonal frequency division multiple access (OFDMA) or UL-MIMO, it is possible to respond acknowledgement frames not in serial manner but in parallel fashion. In case UL MU simultaneous transmission is allowed for acknowledgement frame transmission in response to DL MU transmission, there are several issues that needs to be solved." *Id.* at 7.

[redacted]

	See generally id. at 2-4 (describing transmission signal processing).
[1C] assigning each RU of the plurality of RUs to a respective station in the plurality of stations, and	*See* disclosures cited above for [1B]. The First '520 Provisional describes "allocat[ing]" or "target[ing]" DL resources to each of a plurality of STAs, and explains that the resources are as defined in 802.11 (*i.e.* they are resource units).
[1D] including a respective set of MAC Protocol Data Units (MPDUs) in each RU of the plurality of RUs,	*See* disclosures cited above for [1B]. "In this example, an AP schedules STA1 and STA2 for DL OFDMA transmission, wherein STA1 is allocated in the lower half of the transmission bandwidth and STA2 is allocated in the upper half of the transmission bandwidth. In this example, the AP's DL MU PPDU comprises two independent AMPDUs, wherein the first AMPDU is targeted to STA1 and the second AMPDU is targeted to STA2." *Id.* at 12-13.  *Id.* at 13.
[1E] wherein an MPDU in one or more of the RUs in the plurality of RUs includes acknowledgement information indicating properties of a multi-user acknowledgement transmission that the station in the plurality of stations to which the RU is assigned is requested to transmit to acknowledge the downlink multi-user frame;	*See* disclosures cited above for [1B]. "Each of AMPDU comprises an MPDU which includes UL MU acknowledgement scheduling information. The UL MU acknowledgement scheduling information indicates the resource allocation information for each STA's UL MU acknowledgement frame transmission, which follows predetermined time after receiving DL MU PPDU." *Id.* at 11.

[redacted]

	"MAC header part in every MPDU within the AMPDU comprises UL MU acknowledgement scheduling information. The UL MU acknowledgement scheduling information indicates the resource allocation information for each STA's UL MU acknowledgement frame transmission, which follows predetermined time after receiving DL MU PPDU." *Id.* at 12-13.
[1F] transmitting the downlink multi-user frame to the plurality of stations over a wireless channel; and	*See* disclosures cited above for [1B]. *See generally id.* at 2-4 (describing transmission signal processing).
[1G] receiving the uplink multi-user response transmission, the uplink multi-user response transmission including multi-user acknowledgement transmissions respectively and simultaneously transmitted by two or more stations in the plurality of stations,	*See* disclosures cited above for [1B]. "In a predetermined time after receiving the DL MU PPDU, the receiver sends UL acknowledgement frame in MU fashion, following the resource allocation that is given in the MU acknowledgement scheduling part of the received PPDU." *Id.* at 11. "The UL MU acknowledgement scheduling information indicates the resource allocation information for each STA's UL MU acknowledgement frame transmission, which follows predetermined time after receiving DL MU PPDU." *Id.* at 13. *See also* Figures on pages 12 and 13. *See generally id.* at 4-5 (describing receiver signal processing).
[1H] wherein the plurality of RUs respectively correspond to a plurality of simultaneous uplink transmissions, and each of the plurality of simultaneous uplink transmissions uses a sub-channel, spatial stream, or sub-channel and spatial stream combination that is not used by any other of the plurality of simultaneous uplink transmissions.	*See* disclosures cited above for [1B]. The plurality of RUs respectively correspond to a plurality of simultaneous uplink transmissions because the downlink RUs contain acknowledgement scheduling information, and each of the corresponding simultaneous uplink transmissions use the resource allocation specified in the corresponding RU.

[redacted]

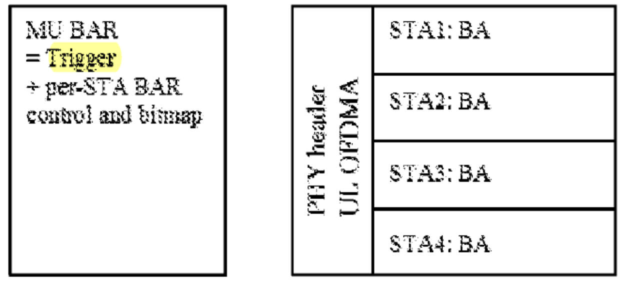
	"...the per-STA information is information that is specific resource allocation to each STA and thus different STAs scheduled in the same DL MU PPDU have different indication information. …a first STA that received the DL AMPDU and if the first STA is the target receiver of the DL AMPDU, the first STA sends acknowledgement frame in predetermined time after receiving the DL frame, wherein the acknowledgement frame is constructed based on the information in the first MPDU in the AMPDU." *Id.* at 12. "…the per-STA information is information that is specific resource allocation to each STA and thus different STAs scheduled in the same DL MU PPDU have different indication information." *Id.* at 13. *See also* Figures on pages 12 and 13 (showing each uplink transmission using different subchannels).

Claim 2	First '520 Provisional
2. The method of claim 1, wherein generating the downlink multi-user frame further comprises: including the acknowledgement information, for indicating properties of the multi-user acknowledgement transmission transmitted by each respective station in the plurality of stations to acknowledge the downlink multi-user frame, in a header of the one or more MPDUs.	*See* disclosures cited above for [1]. "In one embodiment of this approach, all MPDUs within the AMPDU of the DL MU PPDU for each scheduled STA have the scheduling information for UL MU acknowledgement frame transmission in the MAC header part. In another embodiment of this approach, at least one of MPDUs within the AMPDU of the DL MU PPDU for each scheduled STA have the scheduling information for UL MU acknowledgement frame transmission in the MAC header part." *Id.* at 13.

Claim 3	First '520 Provisional
3. The method of claim 2, wherein the header is a MAC header of the one or more MPDUs.	*See* disclosures cited above for [2].

Claim 4	First '520 Provisional
4. The method of claim 1, wherein one of the one or more MPDUs in each of the	*See* disclosures cited above for [1].

[redacted]

<table>
<tr>
<td>RUs of the plurality of RUs is a unicast trigger frame that contains the acknowledgement information for the respective station in the plurality of stations.</td>
<td>

Id. at 15.

"…the AP can have BAR/BA sequence in MU simultaneous transmission … an AP sends an AMPDU to each scheduled STA in DL MU transmission, and the AMPDU comprises the BAR information and the UL BA transmission scheduling information." Id. at 15.</td>
</tr>
</table>

<table>
<tr>
<th>Claim 5</th>
<th>First '520 Provisional</th>
</tr>
<tr>
<td>5. The method of claim 4, wherein the trigger frame instigates each respective station in the plurality of stations to transmit the multi-user acknowledgement transmission after an interframe spacing period following receipt of the downlink multi-user frame.</td>
<td>See disclosures cited above for [4].

Table 8-9—Ack Policy subfield in QoS Control field of QoS Data frames
<table>
<tr><th colspan="2">Bits in QoS Control field</th><th rowspan="2">Meaning</th></tr>
<tr><th>Bit 5</th><th>Bit 6</th></tr>
<tr><td>0</td><td>0</td><td>Normal Ack or Implicit Block Ack Request.

In a frame that is a non-A-MPDU frame or VHT single MPDU:
The addressed recipient returns an Ack or QoS +CF-Ack frame after a short interframe space (SIFS) period, according to the procedures defined in 9.3.2.9 (Ack procedure) and 9.22.3.5 (HCCA transfer rules). A non-DMG STA sets the Ack Policy subfield for individually addressed QoS Null (no data) frames to this value.

Otherwise:
The addressed recipient returns a BlockAck frame, either individually or as part of an A-MPDU starting a SIFS after the PPDU carrying the frame, according to the procedures defined in 9.3.2.10 (Block ack procedure), 9.24.7.5 (Generation and transmission of BlockAck frames by an HT STA or DMG STA), 9.24.8.3 (Operation of HT-delayed block ack), 9.28.3 (Rules for RD initiator), 9.28.4 (Rules for RD responder), and 9.32.3 (Explicit feedback beamforming).</td></tr>
</table>
Id. at 9 ("The addressed recipient returns a BlockAck frame, either individually or as part of an A-MPDU starting a SIFS after the PPDU carrying the frame…").</td>
</tr>
</table>

Claim 6	First '520 Provisional
6[A]. The method of claim 1, further comprising:	*See* disclosures cited above for [1].
[6B] generating, by the network device, a multi-user block acknowledgement request frame to	*See* disclosures cited above for [4].

[redacted]

solicit acknowledgements from two or more stations of the plurality of stations; and	"For this approach, implementation of MU BAR frame transmission can have multiple different embodiments. In one embodiment, a single MU BAR frame is constructed, wherein the MU BAR frame comprises BAR information for each scheduled STA and UL BA transmission scheduling information for each scheduled STA. In another embodiment, an AP sends an AMPDU to each scheduled STA in DL MU transmission, and the AMPDU comprises the BAR information and the UL BA transmission scheduling information. In another embodiment, an AP sends the following frames in DL MU transmission; 1) one BAR to each STA, and 2) one broadcast/multicast frame for UL MU BA transmission." *Id.* at 15.
[6C] transmitting the multi-user block acknowledgment request frame following transmission of the downlink multi-user frame.	*See* disclosures cited above for [4]. *See* Figure on page 15 (showing MU BAR frame following DL MU frame).

Claim 8	**First '520 Provisional**
8[A]. A method, implemented by a first station in a wireless network, for transmitting an uplink acknowledgment, the method comprising:	*See* disclosures cited above for 1[A].
[8B] receiving a downlink multi-user frame addressed to a plurality of stations, including the first station, and received from an access point in the wireless network;	*See* disclosures cited above for 1[B], 1[F]. *See generally id.* at 4-5 (describing receiver signal processing).
[8C] processing a first MAC Protocol Data Units (MPDU) in the downlink multi-user frame to determine acknowledgement information indicating properties of a first multi-user acknowledgement frame;	*See* disclosures cited above for 1[D], 1[E].
[8D] generating the first multi-user acknowledgment frame based on the acknowledgement information; and	*See* disclosures cited above for 1[G]. *See generally id.* at 2-4 (describing transmission signal processing).

[redacted]

[8E] transmitting the first multi-user acknowledgement frame to the access point to acknowledge the downlink multi-user frame,	*See* disclosures cited above for 1[G]. *See generally id.* at 2-4 (describing transmission signal processing).
[8F] wherein the first multi-user acknowledgement frame is transmitted simultaneously to a second multi-user acknowledgement frame transmitted by a second station.	*See* disclosures cited above for 1[H].

Claim 9	**First '520 Provisional**
9. The method of claim 8, wherein the first MPDU is located in a first resource unit of the downlink multi-user frame allocated to the first station, wherein the downlink multi-user frame includes a second resource unit that contains a second MPDU that includes acknowledgement information for the second multi-user acknowledgement frame.	*See* disclosures cited above for [2], [8]. "...the per-STA information is information that is specific resource allocation to each STA and thus different STAs scheduled in the same DL MU PPDU have different indication information. …a first STA that received the DL AMPDU and if the first STA is the target receiver of the DL AMPDU, the first STA sends acknowledgement frame in predetermined time after receiving the DL frame, wherein the acknowledgement frame is constructed based on the information in the first MPDU in the AMPDU." *Id.* at 12. "…the per-STA information is information that is specific resource allocation to each STA and thus different STAs scheduled in the same DL MU PPDU have different indication information." *Id.* at 13. "In this example, the AP's DL MU PPDU comprises two independent AMPDUs, wherein the first AMPDU is targeted to STA1 and the second AMPDU is targeted to STA2. And, each of AMPDU comprises an MPDU which includes UL MU acknowledgement scheduling information. The UL MU acknowledgement scheduling information indicates the resource allocation information for each STA's UL MU acknowledgement frame transmission, which follows predetermined time after receiving DL MU PPDU." *Id.* at 11.

[redacted]

	"Each target receiver of DL MU PPDU receives the DL MU PPDU and checks the Preamble part of the frame, wherein the Preamble part indicates the allocated resource for each target receiver." *Id.* at 11.

Claim 10	**First '520 Provisional**
10. The method of claim 9, wherein the first multi-user acknowledgement frame and the second multi-user acknowledgement frame together form a multi-user acknowledgement frame for acknowledging the downlink multi-user frame.	*See* disclosures cited above for [9]. *See also* Figures on pages 12, 13, and 15 (showing UL MU acknowledgement frame).

Claim 11	**First '520 Provisional**
11. The method of claim 8, wherein processing the first MPDU comprises: extracting the acknowledgement information indicating the properties of the first multi-user acknowledgement frame from a header of the first MPDU.	*See* disclosures cited above for [2], [8].

Claim 12	**First '520 Provisional**
12. The method of claim 11, wherein the header is a MAC header of the first MPDU.	*See* disclosures cited above for [2], [11].

Claim 13	**First '520 Provisional**
13. The method of claim 8, wherein processing the MPDU comprises: extracting the acknowledgement information indicating the properties of the first multi-user acknowledgement frame transmission from a payload of the first MPDU, wherein the first MPDU is a unicast trigger frame.	*See* disclosures cited above for [4], [8].

Claim 14	**First '520 Provisional**
14. The method of claim 13, further comprising: processing a second MPDU in a same resource unit as the first MPDU, wherein the second MPDU includes data intended for the first station.	*See* disclosures cited above for [13]. "In one embodiment, the scheduling information for UL MU acknowledgement frame transmission forms a MPDU, and the MPDU is aggregated with other DL data MDPUs of each scheduled STA in

[redacted]

	A-MPDU format. … In another embodiment, together with DL data MPDU, an AP sends a first MPDU in an AMPDU manner, wherein the first MPDU includes scheduling information for UL MU acknowledgement frame transmission." *Id.* at 12. *See also* Figures on page 12 and 13 (showing second MPDU in same resource unit containing data for first station).

Claim 15	**First '520 Provisional**
15. The method of claim 13, wherein the trigger frame instigates the first station to transmit the first multi-user acknowledgement after an interframe spacing period following receipt of the downlink multi-user frame.	*See* disclosures cited above for [5], [13].

Claim 16	**First '520 Provisional**
16. The method of claim 8, further comprising: receiving a multi-user block acknowledgement request frame that solicits acknowledgements from the first and second station, wherein the first multi-user acknowledgement frame is transmitted after receipt of and in response to the multi-user block acknowledgement request frame.	*See* disclosures cited above for [6], [13].

Claim 18	**First '520 Provisional**
18[A]. A method, implemented by a first station in a wireless network, for transmitting an uplink acknowledgment, the method comprising:	*See* disclosures cited above for 8[A].
[18B] receiving a downlink multi-user frame addressed to a plurality of stations, including the first station, wherein the downlink multi-user frame is received from an access point in the wireless network;	*See* disclosures cited above for 8[B].
[18C] receiving a multi-user block acknowledgement request frame that solicits acknowledgements from the first station and a second station,	*See* disclosures cited above for [6], 8[C]. "…the AP can have BAR/BA sequence in MU simultaneous transmission … an AP sends an

[redacted]

wherein the multi-user block acknowledgement request frame includes acknowledgement information indicating properties of a first multi-user acknowledgement frame;	AMPDU to each scheduled STA in DL MU transmission, and the AMPDU comprises the BAR information and the UL BA transmission scheduling information." *Id.* at 15.
[18D] generating the first multi-user acknowledgment frame based on the acknowledgement information; and	*See* disclosures cited above for 8[D].
[18E] acknowledging the receipt of the downlink multi-user frame by transmitting the first multi-user acknowledgement frame to the access point,	*See* disclosures cited above for 8[E].
[18F] wherein the first multi-user acknowledgement frame is transmitted simultaneously with a second multi-user acknowledgement frame generated and transmitted by the second station.	*See* disclosures cited above for 8[F].

Claim 19	**First '520 Provisional**
19. The method of claim 18, wherein the acknowledgement information includes one or more of: (1) an indication of whether the first multi-user acknowledgement frame is part of a multi-user or single user transmission and (2) resource scheduling information for the first multi-user acknowledgement transmission.	*See* disclosures cited above for [18]. "In the first approach, a specific method for acknowledgement frame transmission is further indicated in the MAC header, such that new STA can identify which method is supposed to be used … When Ack Policy subfield is set a state to indicate immediate acknowledgement, which in current definition corresponds to 'Normal Ack or Implicit Block Ack Request,' another subfield (a first subfield) indicates if the following acknowledgement shall be a single user acknowledgement or a MU acknowledgement." *Id.* at 8-9. "…if the first subfield is set to MU acknowledgement state, there is a second part in the MU PPDU that comprises resource allocation information for MU acknowledgement frame transmission." *Id.* at 11.

Claim 20	**First '520 Provisional**

[redacted]

20. The method of claim 18, wherein the acknowledgment scheduling information includes properties of the second multi-user acknowledgement frame generated and transmitted by the second station, wherein the first multi-user acknowledgement frame and the second multi-user acknowledgement together form a multi-user transmission.	*See* disclosures cited above for [9], [10], and [18].

8.2.2 The Second '520 Provisional

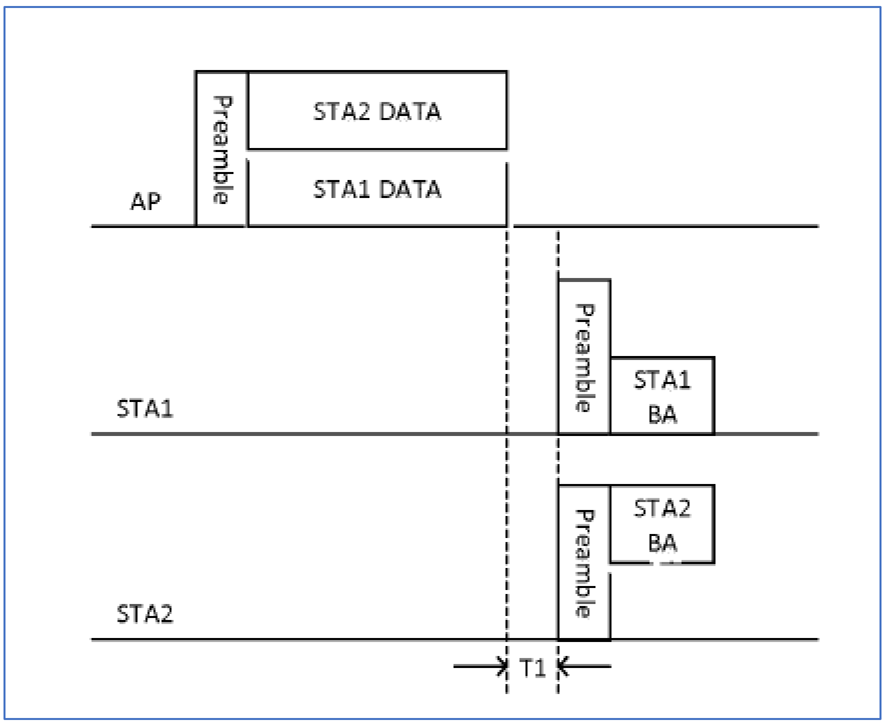
66. The Second '520 Provisional (ATLAS-00004132-4160) is titled "Apparatus and Methods for Transmitting Response Frames." Many of the disclosures in the Second Provisional are similar to those in the First Provisional, but the Second Provisional presents these disclosures more from the perspective of a station rather than an access point.

67. The Second '520 Provisional describes ways to implement DL MU trigger frames that solicit simultaneous uplink MU acknowledgments: "IEEE 802.11ax supports DL MU transmission schemes more broadly which includes DL MU-MIMO and DL orthogonal frequency division multiple access (DL OFDMA) schemes. And, IEEE 802.11ax also supports uplink (UL) MU transmission schemes such as UL MU-MIMO and UL OFDMA, where multiple STAs can send simultaneously to the same AP. As IEEE 802.11ax standard further includes the concept of uplink multi-user simultaneous transmission, it is possible to respond acknowledgement frames not in serial manner but in parallel fashion." *Id.* at 7.

68. The Second '520 Provisional describes several specific embodiments, including embodiments similar to the Figure 7 embodiment I discussed above. "The drawing below illustrates DL OFDMA transmission with UL OFDMA response. In this example, an AP transmits data frames to STA1 and STA2 simultaneously using DL OFDMA technique. The AP allocates radio resource of lower channel bandwidth to STA1 and radio resource of upper channel bandwidth to STA2, and transmits data frames simultaneously. Then, after receiving the AP's data frames, both STA1 and STA2 may send acknowledgement frames in UL OFDMA manner. Both STA1and STA2 can identify their allocated resource

[redacted]

for acknowledgement frame transmission based on the received frame, and thus, STA1 and STA2 sends their acknowledgement frames in predetermined time (T1) after receiving the DL OFDMA frame. In this example, STA1 allocated resource for Blok Ack frame (BA) transmission is the lower half of the channel bandwidth and STA2's allocated resource for BA transmission is the upper half of the channel bandwidth. Also, at least part of UL preamble part occupies the whole channel bandwidth and both STA1 and STA2 sends with identical information, such that the signal from STA1 and STA2 are combined together in the air. As the acknowledgement frames for DL data transmission is transmitted in parallel from STA1 and STA2, this mechanism can reduce acknowledgement overhead." *Id.* at 7-8



Id. at 8.

8.3 Prosecution History

69. On March 23, 2016, the Applicant filed the '520 application with 20 initial claims. ATLAS-00003906-3965.

[redacted]

70. On June 9, 2016, the examiner issued a single-reference obviousness rejection of claims 1-20 under 35 U.S.C. §103 in light of "Wang" (U.S. 2013/0301569). ATLAS-00003974-3983.

71. On July 20, 2016 the applicant conducted an interview with the examiner. ATLAS-00004063.

72. The applicant submitted an interview summary on July 22, 2016 along with a set of claim amendments. ATLAS-00004051-58. The applicant explained, among other things, that Wang does not disclose uplink multi-user transmissions and therefore does not render the claims unpatentable. *Id.*

73. On August 15, 2016, the examiner issued a notice of allowance. ATLAS-00004065-73.

74. The '520 Patent issued on December 27, 2016.

8.4 Overview of Alleged '520 Prior Art

75. Dr. Hansen analyzes five references in connection with the '520 Patent: (1) U.S. Patent Publication 2015/0124690 to Merlin ("Merlin 690," Hansen Ex. 520-2), (2) U.S. Patent Publication 2010/0260114 to Vermani ("Vermani," Hansen Ex. 520-3), (3) U.S. Patent Publication 2017/0338910 to Chun ("Chun," Hansen Ex. 520-4), (4) U.S. Patent Publication 2017/0367077 to Shu ("Shu," Hansen Ex. 520-5), and (5) U.S. Patent No. 10,257,806 to Chu ("Chu," Hansen Ex. 520-6). Hansen Report at ¶154. I provide an overview of each below.

8.4.1 Merlin '690

76. Merlin '690 is titled "Method and Apparatus for Transmitting Response Frame Based on Type in a High Efficiency Wireless LAN." Merlin '690 generally relates to the "frame structures and protocols for uplink multiple user (MU) frame exchanges." Merlin '690 at [0003]. It explains that an AP may send a DL MU frame that solicits an immediate response from a plurality of STAs, and those STAs may immediately respond with an UL acknowledgment—either an ACK or a block ACK. *Id.* at [0009]. The AP's DL MU frame may signal "which STAs are solicited for immediate response (*e.g.*, for immediate BAs),

[redacted]

which STAs may use existing ACK policy indications, [and] which mode is to be used for the replies (*e.g.*, UL SU-MIMO, UL MU-MIMO, or UL MU OFDMA)." *Id.* at [0125]. Further, Merlin '690 teaches "a response type indication for each STA may be added [to the DL MU PPDU]. For example 1 or 2 bits may indicate which mode of response is to be used (*e.g.*, UL SU-MIMO, UL MU-MIMO, or UL OFDMA)." *Id.* at [0133]. And the "indication may be included in the Quality of Service (QoS) control field," for example. *Id.* Merlin '690 also discloses various acknowledgment policies, including "normal ACK," "No ACK," and "delayed BA" policies. *Id.* at [0127]-[0128]. As I discuss in more detail below, Merlin lacks many key concepts of the '520 Patent claims, such as the concept of downlink resource units, downlink resource allocation, and the concept of embedding MPDUs in resource units.

8.4.2 Vermani

77. Vermani is titled "Acknowledgement Resource Allocation and Scheduling for WLANs." Vermani characterizes itself as disclosing "methods and apparatuses for communication by which a physical layer packet is generated for transmission to a plurality of nodes, or by which a physical layer packet is received by a plurality of nodes, wherein a resource allocation for each of the plurality of nodes to send an acknowledgement to an apparatus or a transmitting node is included in the physical layer packet." *Id.* at Abstract. As I discuss in more detail below, Vermani lacks many key concepts of the '520 Patent claims, such as the concept of downlink resource units, downlink resource allocation, and the concept of trigger frames.

8.4.3 Chun

78. Chun is titled "Data Transmission Method in Wireless Communication System and Device Therefor." Chun characterizes itself as disclosing a "method for performing an uplink (UL) multi-user (MU) transmitting performed by a station (STA) apparatus in a Wireless LAN (WLAN) system according to an embodiment of the present invention may include receiving a downlink (DL) MU frame: generating a UL MU Acknowledge (ACK) frame;

[redacted]

and UL MU transmitting the UL MU ACK frame, wherein the UL MU ACK frame includes a legacy preamble, a high efficiency (HE) preamble and an Acknowledge (ACK) field, and is UL MU transmitted by being constructed as a null data packet (NDP) frame format that does not include a data field." *Id.* at Abstract.

79. As I discuss below, Chun is not prior art to the '520 Patent. Moreover, it lacks many key limitations of the '520 Patent claims, such as the concept of downlink resource units and downlink resource allocation.

8.4.4 Shu

80. Shu is titled "Data Transmission Method and Apparatus Used in Wireless Local Area Network." Shu characterizes itself as disclosing "method and an apparatus for acknowledging transmission of downlink data frames by multiple stations in a wireless local area network. The method includes: sending, by an access point, a corresponding downlink data frame to each station of the multiple stations; and receiving, by the access point after the access point sends the corresponding downlink data frame to each station, acknowledgment messages concurrently sent by the multiple stations on channel resources allocated by the access point to the multiple stations. According to the method and the apparatus provided in the embodiments of the present invention, time required by the multiple stations to feed back the acknowledgment messages can be reduced." *Id.* at Abstract. As I discuss in more detail below, Shu lacks many key concepts of the '520 Patent claims, such as the concept of downlink resource units, downlink resource allocation, and the concept of embedding MPDUs in resource units.

8.4.5 Chu

81. Chu is titled "Medium Access Control for Multi-Channel OFDM in a Wireless Local Area Network." Chu characterizes itself as disclosing a "first communication device allocates respective sub-channels of an orthogonal frequency division multiplexing (OFDM) channel to two or more second communication devices for uplink orthogonal frequency division multiple access (OFDMA) transmission from the two or more second

[redacted]

communication devices. A first sub-channel is allocated to a first one of the second communication devices and a second sub-channel is allocated to a second one of the second communication devices. The first communication device provides, to the second communication devices, indications of the respective sub-channels allocated to the second communication devices. The first communication device receives an uplink OFDMA data unit that includes a first OFDM data unit transmitted from the first one of the second communication devices via the first sub-channel, and a second OFDM data unit transmitted from the second one of the second communication devices via the second subchannel." *Id.* at Abstract. As I discuss in more detail below, Chu lacks many key concepts of the '520 Patent claims, such as the concept of downlink resource units, the claimed scheduling information, and the concept of embedding MPDUs in resource units.

8.5 Asserted Claims

82. The '520 Asserted Claims are reproduced below:

Claim 1
1[A]. A method, implemented by a network device in a wireless network, for coordinating an uplink multi-user response transmission to a downlink multiuser transmission, the method comprising:
[1B] generating, by the network device, a downlink multi-user frame addressed to a plurality of stations operating in the wireless network, the downlink multi-user frame including a plurality of resource units (RUs), wherein generating the downlink multi-user frame comprises:
[1C] assigning each RU of the plurality of RUs to a respective station in the plurality of stations, and
[1D] including a respective set of MAC Protocol Data Units (MPDUs) in each RU of the plurality of RUs,
[1E] wherein an MPDU in one or more of the RUs in the plurality of RUs includes acknowledgement information indicating properties of a multi-user acknowledgement transmission that the station in the plurality of stations to which the RU is assigned is requested to transmit to acknowledge the downlink multi-user frame;
[1F] transmitting the downlink multi-user frame to the plurality of stations over a wireless channel; and
[1G] receiving the uplink multi-user response transmission, the uplink multi-user response transmission including multi-user acknowledgement transmissions respectively and simultaneously transmitted by two or more stations in the plurality of stations,
[1H] wherein the plurality of RUs respectively correspond to a plurality of simultaneous uplink transmissions, and each of the plurality of simultaneous uplink transmissions uses a

[redacted]

sub-channel, spatial stream, or sub-channel and spatial stream combination that is not used by any other of the plurality of simultaneous uplink transmissions.

Claim 2
2. The method of claim 1, wherein generating the downlink multi-user frame further comprises: including the acknowledgement information, for indicating properties of the multi-user acknowledgement transmission transmitted by each respective station in the plurality of stations to acknowledge the downlink multi-user frame, in a header of the one or more MPDUs.

Claim 3
3. The method of claim 2, wherein the header is a MAC header of the one or more MPDUs.

Claim 4
4. The method of claim 1, wherein one of the one or more MPDUs in each of the RUs of the plurality of RUs is a unicast trigger frame that contains the acknowledgement information for the respective station in the plurality of stations.

Claim 5
5. The method of claim 4, wherein the trigger frame instigates each respective station in the plurality of stations to transmit the multi-user acknowledgement transmission after an interframe spacing period following receipt of the downlink multi-user frame.

Claim 6
6[A]. The method of claim 1, further comprising:
[6B] generating, by the network device, a multi-user block acknowledgement request frame to solicit acknowledgements from two or more stations of the plurality of stations; and
[6C] transmitting the multi-user block acknowledgment request frame following transmission of the downlink multi-user frame.

Claim 8
8[A]. A method, implemented by a first station in a wireless network, for transmitting an uplink acknowledgment, the method comprising:
[8B] receiving a downlink multi-user frame addressed to a plurality of stations, including the first station, and received from an access point in the wireless network;
[8C] processing a first MAC Protocol Data Units (MPDU) in the downlink multi-user frame to determine acknowledgement information indicating properties of a first multi-user acknowledgement frame;
[8D] generating the first multi-user acknowledgment frame based on the acknowledgement information; and
[8E] transmitting the first multi-user acknowledgement frame to the access point to acknowledge the downlink multi-user frame,
[8F] wherein the first multi-user acknowledgement frame is transmitted simultaneously to a second multi-user acknowledgement frame transmitted by a second station.

[redacted]

Claim 9
9. The method of claim 8, wherein the first MPDU is located in a first resource unit of the downlink multi-user frame allocated to the first station, wherein the downlink multi-user frame includes a second resource unit that contains a second MPDU that includes acknowledgement information for the second multi-user acknowledgement frame.

Claim 10
10. The method of claim 9, wherein the first multi-user acknowledgement frame and the second multi-user acknowledgement frame together form a multi-user acknowledgement frame for acknowledging the downlink multi-user frame.

Claim 11
11. The method of claim 8, wherein processing the first MPDU comprises: extracting the acknowledgement information indicating the properties of the first multi-user acknowledgement frame from a header of the first MPDU.

Claim 12
12. The method of claim 11, wherein the header is a MAC header of the first MPDU.

Claim 13
13. The method of claim 8, wherein processing the MPDU comprises: extracting the acknowledgement information indicating the properties of the first multi-user acknowledgement frame transmission from a payload of the first MPDU, wherein the first MPDU is a unicast trigger frame.

Claim 14
14. The method of claim 13, further comprising: processing a second MPDU in a same resource unit as the first MPDU, wherein the second MPDU includes data intended for the first station.

Claim 15
15. The method of claim 13, wherein the trigger frame instigates the first station to transmit the first multi-user acknowledgement after an interframe spacing period following receipt of the downlink multi-user frame.

Claim 16
16. The method of claim 8, further comprising: receiving a multi-user block acknowledgement request frame that solicits acknowledgements from the first and second station, wherein the first multi-user acknowledgement frame is transmitted after receipt of and in response to the multi-user block acknowledgement request frame.

Claim 18
18[A]. A method, implemented by a first station in a wireless network, for transmitting an uplink acknowledgment, the method comprising:

[redacted]

[18B] receiving a downlink multi-user frame addressed to a plurality of stations, including the first station, wherein the downlink multi-user frame is received from an access point in the wireless network;
[18C] receiving a multi-user block acknowledgement request frame that solicits acknowledgements from the first station and a second station, wherein the multi-user block acknowledgement request frame includes acknowledgement information indicating properties of a first multi-user acknowledgement frame;
[18D] generating the first multi-user acknowledgment frame based on the acknowledgement information; and
[18E] acknowledging the receipt of the downlink multi-user frame by transmitting the first multi-user acknowledgement frame to the access point,
[18F] wherein the first multi-user acknowledgement frame is transmitted simultaneously with a second multi-user acknowledgement frame generated and transmitted by the second station.

Claim 19
19. The method of claim 18, wherein the acknowledgement information includes one or more of: (1) an indication of whether the first multi-user acknowledgement frame is part of a multi-user or single user transmission and (2) resource scheduling information for the first multi-user acknowledgement transmission.

Claim 20
20. The method of claim 18, wherein the acknowledgment scheduling information includes properties of the second multi-user acknowledgement frame generated and transmitted by the second station, wherein the first multi-user acknowledgement frame and the second multi-user acknowledgement together form a multi-user transmission.

8.6 Claim Construction

83. The Court issued a claim construction order on February 8, 2023 ("Claim Construction Order" or "Markman Order"). Dkt. No. 117. I have applied the constructions therein. For terms the court did not construe, I have applied the plane and ordinary meaning to a person of ordinary skill in the art at the time of invention.

84. With respect to the '520 Patent, the Court construed the following terms:

Term or phrase	**Court's Construction**
"the downlink multi-user frame including a plurality of resource units (RUs)" (claim 1)	Plain meaning
"including a respective set of MAC Protocol Data Units (MPDUs) in each RU of the plurality of RUs" (claim 1)	Plain meaning
"wherein the first MPDU is located in a first resource unit of the downlink	Plain meaning

[redacted]

multi-user frame allocated to the first station, wherein the downlink multi-user frame includes a second resource unit that contains a second MPDU that includes acknowledgement information for the second multi-user acknowledgement frame" (claim 9)	
"network device" (claims 1, 6)	Plain meaning

Dkt. 117 at 8-20.

85. In its analysis for the first three terms, the Court explicitly rejected TP-Link's indefiniteness positions. *Id.* at 9-12, 13-15. And for the last term, the Court rejected TP-Link's position that a "network device" is limited to an access point. *Id.* at 17-20.

8.7 Dr. Hansen's Alleged Prior Art Does Not Invalidate the Asserted '520 Claims

86. Dr. Hansen states that each of the following references anticipate the Asserted '520 claims: Merlin '690, Vermani, Chun, Shu, and Chu. Hansen Report at ¶154. Dr. Hansen also states that those same references render the Asserted '520 claims obvious, either by themselves or in any combination of those five references. *Id.* I disagree.

8.7.1 Merlin '690 Fails To Disclose Or Render Obvious Several '520 Claim Limitations

8.7.1.1 Element 1 [a]: generating, by the network device, a downlink multi-user frame addressed to a plurality of stations operating in the wireless network, the downlink multi-user frame including a plurality of resource units (RUs), wherein generating the downlink multi-user frame comprises:

87. Dr. Hansen states that Merlin '690 teaches Element 1[a]. Hansen Report at ¶¶191-95. Dr. Hansen cites Merlin '690 at ¶¶ [0009], [0094], and [0119]. I disagree.

88. As a first matter, none of the cited passages disclose "resource units (RUs)" and it is unclear from Dr. Hansen's analysis why any feature of Merlin '690 is the claimed "resource units".

89. In the context of the '520 Patent, a POSITA would understand the plain and ordinary meaning of "resource units (RUs)" to connote particular units of wireless channel resources. For example, resource units can be formed by dividing the wireless channel into predefined frequency subchannels. Each predefined frequency subchannel may thus be

[redacted]

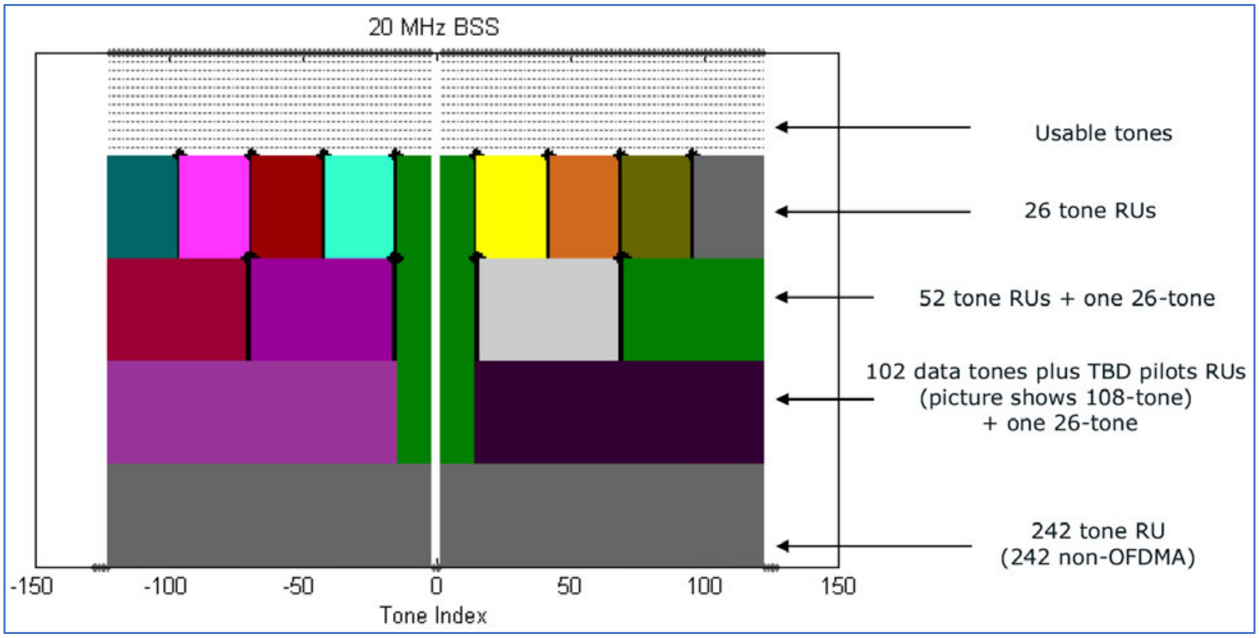
viewed as predefined "unit" of "resources" that can be used for transmitting information. It is important that resources be partitioned into particular "units" so that resource allocations can be efficiently and reliably signaled by the transmitting device and understood by the receiving devices.

90. The '520 Patent's teachings confirm this plain and ordinary meaning of "resource units," for example: "The resource units may be ***particular*** spatial streams or sub-channels of a wireless channel upon which the DL MU frame will be transmitted." '520 at 14:12-14 (emphasis added). This disclosure makes clear that an ad hoc or arbitrary allocation of wireless channel resources is not a "resource unit" in the context of the '520 Patent. Rather, a resource unit must consist of "particular" predefined units of resources.

91. The '520 Patent also makes repeated reference to the 802.11 standard and explains the invention exists within the context of ongoing 802.11 standardization activities related to multi-user ("MU") communications. *See*, *e.g.*, '520 at 4:65-5:3 ("During the standardization activities of the Institute of Electrical and Electronics Engineers (IEEE) 802.11, multiuser (MU) simultaneous transmission techniques such as Orthogonal Frequency Division Multiple Access (OFDMA) and Multi-User Multiple Input Multiple Output (MUMIMO) are considered to improve network efficiency.") The inventors of the '520 Patent were participants in ongoing 802.11ax standardization activities. A POSITA reading the '520 Patent would understand the plain and ordinary meaning of "resource units" within this context of ongoing 802.11ax standardization.

92. The TGax submission "IEEE 802.11-15/0330r1 - OFDMA Numerology and Structure" is dated March 9, 2015. ATLAS-00029021-58. This document discusses subdividing the 242 tones of the 20 MHz channel into defined "resource units" as small as 26 tones each, *i.e.*, the 20MHz channel would be subdivided into up to nine resource units. *Id.* at 13. This is illustrated graphically in the document:

[redacted]



Id. at 24. This document illustrates that a POSITA at the time of the '520 Patent would have understood "resource units" to connote particular, predefined units of resources, not merely any allocation of resources. In the context of 802.11ax, as well as in prior versions of 802.11, resources cannot be allocated on an ad hoc or arbitrary basis. A wireless device can only allocate particular units of resources. Thus, for example, a device can allocate up to nine resource units in a 20MHz channel, but cannot allocate, for example, twelve resource units. Nor can a device allocate a fraction of a resource unit. Instead, "resource units" are limited to particular, predefined units of resources, *i.e.*, 26 tones, 52 tones, 102 tones, and/or 242 tones in a 20MHz channel.

93. The document "IEEE 802.11-15/0330r1 - OFDMA Numerology and Structure" also states at Slide 28 "Fixed Position of Building Blocks … The proposed resource units are at fixed positions (as shown below) – RUs are building blocks for the scheduler to assign them to different users." This further emphasizes that a POSITA would understand "resource units" to connote fixed, predefined building blocks of resources, rather than an arbitrary or ad hoc allocation of resources.

94. Among the authors of IEEE 802.11-15/0330r1 are Simone Merlin, Gwendolyn Barriac, and Hemanth Sampath, the three alleged inventors of Merlin '690. This strongly suggests

[redacted]

that the inventors of Merlin ’690 were aware of the concept of “resource units” in the context of 802.11 standardization. However, these inventors appear to have made the deliberate choice to not teach “resource units” in Merlin ’690. Neither the term “resource unit” nor any equivalent term appears in Merlin ’690. Instead, the inventors of Merlin ’690 chose to describe a different kind of system from the one claimed in the ’520 Patent—one that allocates resources ***without*** using particular “resource units.”

95. Additionally, the term “resource units (RUs)” in the context of Claim 1 of the ’520 Patent refers specifically to resource units in a ***downlink*** multi-user frame. This limitation recites “a downlink multi-user frame … including a plurality of resource units (RUs).”

96. Dr. Hansen block quotes Merlin ’690 at ¶¶ [0009], [0094], and [0119]. None of the quoted passages disclose “resource units,” and none of the quoted passages disclose resource units being included in a “downlink multi-user frame.” Merlin ’690 at ¶ [0119] states “Each MU PPDU may be either a MU-MIMO PPDU or a FDMA PPDU. The FDMA PPDU may allocate sub-20 MHz channels.” This does not teach or disclose “resource units” because allocating sub-20 MHz channels does not teach allocating “resource units” as that term is used in the context of the ’520 Patent. This disclosure of Merlin ’690 does not teach any concept of “units” of resources, and instead teaches away from the concept of resource units by permitting the 20MHz channel to be allocated in any arbitrary manner. For example, in Merlin the 20Mhz channel could be allocated into a 1MHz channel, a 3.7MHz channel, and a 15.3MHz channel, or it could be divided into any other conceivable allocation of 20MHz. This is antithetical to the concept of “resource units” in the ’520 Patent as particular, predefined building blocks of resources.

97. Additionally, when Merlin ’690 refers to “allocate[ing] sub-20 MHz channels” it is referring to the sub-channels allocated to STAs for an ***uplink*** transmission. This can be seen from, *e.g.*, the fact that the section heading in Merlin ’690 is titled “Example Protocols for ***UL [Uplink]*** MU Acknowledgements” and paragraph [0118] states “Multiple access is achieved in OFDMA by assigning subsets of subcarriers to individual users. This allows

[redacted]

simultaneous low data rate transmission ***from*** several users." Thus, when Merlin '690 refers to sub-20MHz channels, those channels are used for ***uplink*** transmission. This disclosure does not teach "a ***downlink*** multi-user frame … including a plurality of resource units (RUs)" as required by this claim element, because the resource units in this claim are resource units used by a downlink frame, while the sub-channels in Merlin '690 that Dr. Hansen alleges to disclose the aforementioned resource units, are sub-channels to be used in subsequent uplink frames.

98. Even if one were to agree that the aforementioned sub-channels represent resource units, and as I mentioned above I do not, it is completely evident that these alleged "resource units" have absolutely nothing to do with the resource units described in this claim and thus obviously do not disclose them.

99. Dr. Hansen also opines that "A POSITA would have understood that the OFDMA technology disclosed in Merlin '690, specifically the 'sub-20 MHz channels' above, describes sub-carriers in a channel bandwidth that are grouped into smaller portions than the original 802.11 20 MHz channel format and are often called resources units ('RU')." Hansen Report at ¶194.

100. I disagree. First, the statement does not disclose "sub-carriers in a channel bandwidth that are grouped into smaller portions than the original 802.11 20 MHz channel" because the passage does not mention "groups" or "subcarriers." Additionally, any group of subcarriers is not necessarily a resource unit in the context of the '520 Patent. Instead, a resource unit must be a particular, predefined unit of resources. For example, in the context of 802.11ax as it existed at the time of the '520 Patent, a group of 26 subcarriers could be a resource unit, but a group of, *e.g.*, 20 subcarriers could not be a resource unit. Merlin does not teach or suggest the allocation of resources into resource units.

101. Moreover, as I describe above, the "sub-carriers" referenced in Merlin are allocated for ***uplink*** transmissions, rather than being part of a ***downlink*** MU frame as required by this claim element.

[redacted]

102. For these reasons, it is my opinion that Merlin '690 does not teach or suggest Element 1[a].

8.7.1.2 Element 1 [b]: assigning each RU of the plurality of RUs to a respective station in the plurality of stations, and

103. Dr. Hansen states that Merlin '690 teaches Element 1[b]. Hansen Report at ¶¶227-31. I disagree.

104. When this claim element refers to "the plurality of RUs," it is referring back to "a downlink multi-user frame … including a plurality of resource units (RUs)" in the preceding claim element. Accordingly, the RUs that must be assigned to a respective station in this claim element are the RUs in the ***downlink*** multi-user frame.

105. None of the cited passages disclose this claim element, and Dr. Hansen does not say what statements in the cited passages he believes disclose this claim element. He therefore fails to show that this element is disclosed.

106. As discussed in the preceding section, Merlin '690 does not teach or disclose resource units, and therefore does not teach or disclose this limitation.

107. Dr. Hansen cites several passages of Merlin '690 related to addressing:

- "if all of the addressed STAs in the DL MU-MIMO PPDU support UL MU-MIMO, UL FDMA, or both, then none, some, or all of the STAs may be solicited for immediate response" ¶[0126]
- "DL MIMO/FDMA or MU time aggregated PPDUs, except for the PHY header, the data portion may be received only by the intended (e.g., addressed) STAs" ¶[0123]
- "DL MU-MIMO/FDMA PPDU may have more than one PSDU addressed to HEW STAs having MPDUs with 'Immediate BA or ACK response' policies that solicit an immediate BA or ACK response from the recipient HEW STAs" ¶[0148]

[redacted]

108. These passages discuss addressing STAs or addressing data, but they do not mention any assigning or addressing of wireless channel resources, let alone resource units. In fact, these passages do not mention resources or resource units at all.

109. Dr. Hansen also cites the following passage: "indicating the resource allocation for the STAs to send in UL MU-MIMO or UL FDMA may be accomplished by including the spatial stream/channel allocation and power control for each STA." Merlin '690 at ¶[0162]. As discussed above, allocating resources is not the same thing as allocating "resource units" as that term is used in the '520 Patent.

110. Moreover, this passage describes allocating resources for ***uplink*** ("UL") transmissions, but this claim element requires assigning ***downlink*** resource units.

111. Moreover, none of the above passages teach or suggest assigning ***each*** downlink resource unit to a station. There is no cited teaching that ***any*** resources or resource units must be assigned in a downlink frame, let alone ***each*** resource unit.

112. Another problem with Dr. Hansen's analysis is that he is mixing and matching different embodiments without providing any justification or motivation for why or how a POSITA would combine them. For example, Merlin '690 at ¶[0148] is describing an embodiment of "Example BAR Frames with UL MU-MIMO/FDMA," whereas Merlin '690 at ¶[0162] is describing an embodiment of "Example Multi-STA BAR Frames." Dr. Hansen cites no disclosure in Merlin or elsewhere that suggests combining the various example embodiments would be feasible or desirable for a POSITA.

113. For these reasons, it is my opinion that Merlin '690 does not teach or suggest Element 1[b].

8.7.1.3 Element 1 [c]: including a respective set of MAC Protocol Data Units (MPDUs) in each RU of the plurality of RUs,

114. Dr. Hansen states that Merlin '690 teaches Element 1[c]. Hansen Report at ¶¶251-53. I disagree.

[redacted]

115. None of the cited passages disclose this claim element, and Dr. Hansen does not say what statements in the cited passages he believes disclose this claim element. He therefore fails to show that this element is disclosed.

116. Dr. Hansen cites Merlin ’690 at ¶¶ [0127], [0181]. Neither of these passages describe resource units, nor do they even mention "resources" or "sub-carriers." These passages state, *e.g.*, "the AP may solicit multiple immediate responses by transmitting an MU PPDU including multiple aggregate medium access control (MAC) protocol data units (A-MPDUs) having MPDUs that solicit an immediate response (e.g., MPDUs indicate 'Immediate BA or normal ACK')." *Id.* at ¶ [0127]. These passages do not teach that MPDUs are included in resource units, because Merlin ’690 never mentions resource units.

117. These passages also do not say that MPDUs can be included in downlink sub-channels, because Merlin only discusses subchannels in the uplink context. As I describe above, Merlin ’690's reference to "sub-carriers" is not sufficient to teach or disclose the plain and ordinary meaning of "resource unit" in the context of the ’520 Patent. But even assuming for the sake of argument that sub-carriers are equated with a resource unit, Merlin ’690 still does not teach this limitation because the cited passages do not describe any relationship between MPDUs and sub-carriers and do not say that MPDUs can be included "in" sub-carriers. Additionally, the claimed MPDUs are included in a downlink frame, but Merlin ’690 only describes "assigning subsets of subcarriers to individual users" in the uplink context, as I explain above.

118. For these reasons, it is my opinion that Merlin ’690 does not teach or suggest Element 1[c].

[redacted]

8.7.1.4 Element 1 [d]: wherein an MPDU in one or more of the RUs in the plurality of RUs includes acknowledgement information indicating properties of a multi-user acknowledgement transmission that the station in the plurality of stations to which the RU is assigned is requested to transmit to acknowledge the downlink multi-user frame;

119. Dr. Hansen states that Merlin '690 teaches Element 1[d]. Hansen Report at ¶¶278-82. I disagree.

120. None of the cited passages disclose this claim element, and Dr. Hansen does not say what statements in the cited passages he believes disclose this claim element. He therefore fails to show that this element is disclosed.

121. Dr. Hansen cites Merlin '690 at ¶¶ [0127], [0128], [0133], [0134].

122. As I described above in Element 1[c], none of these passages disclose "an MPDU in one or more of the RUs" because Merlin '690 does not teach or disclose resource units, and does not teach or disclose that MPDUs can be placed "in" resource units.

123. As I described above in Element 1[b], none of these passages disclose "the station in the plurality of stations to which the RU is assigned" because Merlin '690 does not teach assigning downlink RUs to stations, and Merlin '690's only discussion of "assigning subsets of subcarriers to individual users" refers to an assignment in the uplink direction, not an assignment of downlink RUs as required by this claim element.

124. For these reasons, it is my opinion that Merlin '690 does not teach or suggest Element 1[d].

8.7.1.5 Element 9 [a]: The method of claim 8, wherein the first MPDU is located in a first resource unit of the downlink multi-user frame allocated to the first station,

125. Dr. Hansen states that Merlin '690 teaches Element 9[a]. Hansen Report at ¶¶604-05. I disagree.

126. Dr. Hansen exclusively relies on his analysis of Element 1[c] for this element and does not provide any additional citations or analysis.

[redacted]

127. As I explain above at Element 1[a], the cited passages of Merlin ’690 do not disclose “resource units” in a downlink MU frame, in the context of the ’520 claims.

128. As I explain above at Element 1[c], the cited passages of Merlin ’690 do not disclose any MPDUs located in downlink resource units.

129. I incorporate my analysis of Elements 1[a] and 1[c] above.

130. For these reasons, it is my opinion that Merlin ’690 does not teach or suggest Element 9[a].

8.7.1.6 Element 9 [b]: wherein the downlink multi-user frame includes a second resource unit that contains a second MPDU that includes acknowledgement information for the second multi-user acknowledgement frame.

131. Dr. Hansen states that Merlin ‘690 teaches Element 9[b]. Hansen Report at ¶¶620-21. I disagree.

132. Dr. Hansen exclusively relies on his analysis of Element 1[d] for this element and does not provide any additional citations or analysis.

133. As I explain above at Element 1[a], the cited passages of Merlin ’690 do not disclose “resource units” in a downlink MU frame, in the context of the ’520 claims.

134. As I explain above at Element 1[c], the cited passages of Merlin ’690 do not disclose any MPDUs located in downlink resource units.

135. I incorporate my analysis of Elements 1[a], 1[c], and 1[d] above.

136. For these reasons, it is my opinion that Merlin ’690 does not teach or suggest Element 9[b].

[redacted]

8.7.2 Vermani Fails To Disclose Or Render Obvious Several ’520 Claim Limitations

8.7.2.1 Element 1 [a]: generating, by the network device, a downlink multi-user frame addressed to a plurality of stations operating in the wireless network, the downlink multi-user frame including a plurality of resource units (RUs), wherein generating the downlink multi-user frame comprises:

137. Dr. Hansen states that Vermani teaches Element 1[a]. Hansen Report at ¶¶197-201. I disagree.

138. None of the cited passages disclose “resource units (RUs).” Dr. Hansen does not say what statements in the cited passages he believes disclose the claimed “resource units,” and he therefore fails to show that this element is disclosed.

139. As I discuss above in the context of Element 1[a] and Merlin ’690, in the ’520 Patent, a POSITA would understand the plain and ordinary meaning of “resource units (RUs)” to connote particular units of wireless channel resources. An ad hoc or arbitrary allocation of wireless channel resources is not a “resource unit” in the context of the ’520 Patent. Rather, a resource unit must consist of “particular” predefined units of resources. I incorporate that discussion above fully into this section.

140. None of the cited passages of Vermani teach “resource units.” For example, Vermani states “[i]n an OFDMA system, each user is provided with a subset of the available tones (hereinafter, a tone set) for transmission of information.” Vermani at ¶ [0053]. But, as I describe above in the context of Merlin ’690, a set of tones is not necessarily a resource unit. In the context of the ’520 Patent, a resource unit must be a particular, predefined unit of resources and not merely any grouping of tones. For example, in the context of 802.11ax as it existed at the time of the ’520 Patent, a group of 26 tones could be a resource unit, but a group of, *e.g.*, 20 tones could not be a resource unit. Vermani does not teach or suggest the allocation of resources into resource units, and Vermani’s teaching that a user may be allocated any arbitrary set of tones teaches away from a system that uses particular resource units as “building blocks” for resource allocation.

[redacted]

141. In addition, ¶ [0053] of Vermani does not disclose any resources, let alone resource units, being used to transmit a ***downlink*** MU frame as required by this claim element. Vermani at ¶ [0053] describes providing users with a "subset of the available tones" for ***uplink*** transmissions. For example, Vermani states in the same paragraph: "In an OFDMA system, each user is provided with a subset of the available tones (hereinafter, a tone set) ***for transmission*** of information." This statement describes providing users with a tone set that they can use for uplink transmissions, but does not disclose any tone set being used for downlink transmissions to users.

142. Dr. Hansen also cites ¶ [0054] and ¶ [0075] of Vermani, which state: "As shown, by way of example, in FIGS. 5 and 6, in one configuration of a wireless network utilizing OFDMA, the BATA includes a schedule of tone set allocations and epoch(s) for each of the receiving nodes (Ats 101-110) to send its respective BA to the transmitting node (AP 100)" and "FIG. 11 is a flow chart illustrating an example of the functionality of the transmission module 1100. In step 1104, the transmission module 1100 may be used to generate a Block ACK Transmission Allocation (BATA) schedule based on a modulation scheme used in the uplink from each of a plurality of receiving nodes."

143. None of these embodiments show support for "resource units," but rather discuss "tone allocations" or "tone sets" as described in Vermani ¶ [0053]. A tone allocation alone does not teach or disclose a "resource unit" in the context of the '520 Patent, as I discuss above.

144. Moreover, each of these embodiments is describing "tone set allocations" for use in ***uplink*** block acknowledgement transmissions. These passages do not describe resources, let alone resource units, being included in a ***downlink*** MU frame.

145. For these reasons, it is my opinion that Vermani does not teach or suggest Element 1[a].

[redacted]

8.7.2.2 Element 1 [b]: assigning each RU of the plurality of RUs to a respective station in the plurality of stations, and

146. Dr. Hansen states that Vermani teaches Element 1[b]. Hansen Report at ¶¶232-35. I disagree.

147. Dr. Hansen cites Vermani at ¶¶ [0011], [0054].

148. When this claim element refers to "the plurality of RUs," it is referring back to "a downlink multi-user frame … including a plurality of resource units (RUs)" in the preceding claim element. Accordingly, the RUs that must be assigned to a respective station in this claim element are the RUs in the ***downlink*** multi-user frame.

149. As I explain above at Element 1[a], Vermani does not disclose the claimed "resource units" in the context of a "downlink multi-user frame." I incorporate my discussion of Element 1[a] here.

150. Vermani at ¶ [0011] states "The access point includes a wireless network adapter; and a processing system configured to generate a physical layer packet for transmission to a plurality of nodes, the physical layer packet including a resource allocation for each of the plurality of nodes to send an acknowledgement to the apparatus."

151. This passage does not disclose "resource units" in the context of a "downlink multi-user frame." As I explain above at element 1[a], a "resource allocation" is not sufficient to disclose a "resource unit" in the context of the '520 Patent. Additionally, the "resource allocation" described in ¶ [0011] is "for each of the plurality of nodes to send an acknowledgement to the apparatus," *i.e.* it is an ***uplink*** resource allocation, not the claimed downlink assignment of resource units.

152. As I explain above at 1[a], Vermani at ¶ [0054] also does not disclose assigning "resource units" in the context of a "downlink multi-user frame." Rather, it discusses "tone set allocations" for an ***uplink*** transmission.

153. For these reasons, it is my opinion that Vermani does not teach or suggest Element 1[b].

[redacted]

8.7.2.3 Element 1 [g]: wherein the plurality of RUs respectively correspond to a plurality of simultaneous uplink transmissions, and each of the plurality of simultaneous uplink transmissions uses a sub-channel, spatial stream, or sub-channel and spatial stream combination that is not used by any other of the plurality of simultaneous uplink transmissions.

154. Dr. Hansen states that Vermani teaches Element 1[g]. Hansen Report at ¶¶354-57. I disagree.

155. Dr. Hansen cites Vermani at ¶¶ [0055], [0056].

156. As I explain above at Element 1[a] and 1[b], the cited passages of Vermani do not disclose the claimed "plurality of RUs" in the downlink multi-user frame. Accordingly, the RUs cannot "respectively correspond to a plurality of simultaneous uplink transmissions" because there are no disclosed downlink RUs that can correspond to the uplink transmissions. I incorporate my discussions of Elements 1[a] and 1[b] here.

157. Vermani at ¶ [0055] states "each receiving node sends its respective BA simultaneously over the tone set or frequency allocated to that node." However, this passage does ***not*** say that each node will use a "sub-channel, spatial stream, or sub-channel and spatial stream combination that is not used any other of the plurality of simultaneous uplink transmissions." There is no teaching in ¶ [0055] that the "tone set or frequency" allocated to each node must be unique or different from every other node, and there is no mention of "spatial streams" in ¶ [0055].

158. Vermani at ¶ [0056] states "The above example, in which the BAs are sent simultaneously via available tone sets or frequencies for each receiving node in a single epoch may be applied to any downlink modulation scheme, such as TDMA, SDMA and/or OFDMA." This statement likewise does ***not*** say that each node will use a "sub-channel, spatial stream, or sub-channel and spatial stream combination that is not used any other of the plurality of simultaneous uplink transmissions." There is no teaching in ¶ [0056] that the "tone sets or frequencies" allocated to each node must be unique or different from every other node, and there is no mention of "spatial streams" in ¶ [0056].

[redacted]

159. For these reasons, it is my opinion that Vermani does not teach or suggest Element 1[g].

8.7.2.4 Claim 4: The method of claim 1, wherein one of the one or more MPDUs in each of the RUs of the plurality of RUs is a unicast trigger frame that contains the acknowledgement information for the respective station in the plurality of stations.

160. Dr. Hansen states that Vermani teaches Claim 4. Hansen Report at ¶¶427-29. I disagree.

161. Dr. Hansen cites Vermani at ¶ [0054].

162. As I explain above at Element 1[a] and 1[b], ¶ [0054] of Vermani does not disclose the claimed "plurality of RUs" in the downlink multi-user frame. I incorporate my discussions of Elements 1[a] and 1[b] here.

163. In addition, Vermani at ¶ [0054] does not disclose a "unicast trigger frame." This paragraph does not include the words "trigger" or "unicast," nor does it appear to include any similar terms. Dr. Hansen does not identify what he believes is the "unicast trigger frame."

164. Vermani at ¶ [0054] states "the BATA includes a schedule of tone set allocations and epoch(s) for each of the receiving nodes." The fact that the BATA includes information intended for "each" receiving node strongly suggests that the BATA is not a unicast frame, but rather a multicast frame directed to multiple nodes. Moreover, ¶ [0054] does ***not*** state that the BATA is a "trigger" frame.

165. For these reasons, it is my opinion that Vermani does not teach or suggest Claim 4.

8.7.2.5 Element 9 [a]: The method of claim 8, wherein the first MPDU is located in a first resource unit of the downlink multi-user frame allocated to the first station,

166. Dr. Hansen states that Vermani teaches Element 9[a]. Hansen Report at ¶¶606-07. I disagree.

167. Dr. Hansen exclusively relies on his analysis of Element 1[c] for this element and does not provide any additional citations or analysis.

[redacted]

168. As I explain above at Element 1[a], the cited passages of Vermani do not disclose "resource units" in a downlink MU frame, in the context of the '520 claims.

169. I incorporate my analysis of Element 1[a] above.

170. For these reasons, it is my opinion that Vermani does not teach or suggest Element 9[a].

8.7.2.6 Element 9 [b]: wherein the downlink multi-user frame includes a second resource unit that contains a second MPDU that includes acknowledgement information for the second multi-user acknowledgement frame.

171. Dr. Hansen states that Vermani teaches Element 9[b]. Hansen Report at ¶¶622-23. I disagree.

172. Dr. Hansen exclusively relies on his analysis of Element 1[d] for this element and does not provide any additional citations or analysis.

173. As I explain above at Element 1[a], the cited passages of Vermani do not disclose "resource units" in a downlink MU frame, in the context of the '520 claims.

174. I incorporate my analysis of Element 1[a] above.

175. For these reasons, it is my opinion that Vermani does not teach or suggest Element 9[b].

8.7.2.7 Claim 13: The method of claim 8, wherein processing the MPDU comprises: extracting the acknowledgement information indicating the properties of the first multi-user acknowledgement frame transmission from a payload of the first MPDU, wherein the first MPDU is a unicast trigger frame.

176. Dr. Hansen states that Vermani teaches Claim 13. Hansen Report at ¶¶681-82. I disagree.

177. Dr. Hansen exclusively relies on his analysis of Claims 1, 4, and 8 for this element and does not provide any additional citations or analysis.

178. As I explain above at Claim 4, the cited passages of Vermani do not disclose a "unicast trigger frame."

179. I incorporate my analysis of Claim 4 above.

[redacted]

180. For these reasons, it is my opinion that Vermani does not teach or suggest Claim 13.

8.7.3 Chun Fails To Disclose Or Render Obvious Several ’520 Claim Limitations

8.7.3.1 Chun is Not Prior Art

181. Dr. Hansen does not state in his report why he believes Chun is prior art to the ’520 Patent, and does not attempt to show any evidence that Chun is prior art. He does not say what statutory language he believes Chun qualifies as prior art under.

182. Chun states that it was filed October 27, 2015 as PCT Application No. PCT/KR2015/011389 and was published November 23, 2017 as US 2017/0338910.

183. Chun is not prior art to the ’520 Patent because the Chun application was filed after the priority date of the ’520 patent, which was at least March 23, 2015 based on Provisional Application No. 62/137,138.

184. Even if the ’520 Patent was only entitled to its second provisional priority date (No. 62/140,349) filed March 30, 2015, Chun would still not be prior art because Chun was filed after this date.

185. Chun indicates it has a related provisional application (No. 62/068,768) but Dr. Hansen does not indicate or establish that Chun was disclosed or is enabled by that provisional application. As such, Dr. Hansen has not shown that Chun is prior art.

8.7.3.2 Element 1 [a]: generating, by the network device, a downlink multi-user frame addressed to a plurality of stations operating in the wireless network, the downlink multi-user frame including a plurality of resource units (RUs), wherein generating the downlink multi-user frame comprises:

186. Dr. Hansen states that Chun teaches Element 1[a]. Hansen Report at ¶¶202-09. I disagree.

187. Dr. Hansen cites Chun at ¶¶ Abstract, [0015], [0125], [0314] – [0315], [0432] – [0434].

[redacted]

188. Dr. Hansen does not say what statements in the cited passages he believes disclose the claimed "downlink multi-user frame including a plurality of resource units," and he therefore fails to show that this element is disclosed.

189. As I discuss above in the context of Element 1[a] and Merlin '690, in the '520 Patent, a POSITA would understand the plain and ordinary meaning of "resource units (RUs)" to connote particular units of wireless channel resources. An ad hoc or arbitrary allocation of wireless channel resources is not a "resource unit" in the context of the '520 Patent. Rather, a resource unit must consist of "particular" predefined units of resources. I incorporate that discussion above fully into this section.

190. The cited paragraphs discuss UL MU and DL MU transmissions generally, but do not disclose "a plurality of resource units" in the context of the '520 Patent. For example, Chun at ¶ [0433] states "DL MU transmission or UL MU transmission may be multiplexed on a frequency domain or a space domain." The passage does not teach or disclose any particular "units" of frequency or space domain resources. Instead, this passage would be consistent with an arbitrary or ad-hoc allocation of frequency or space domain resources that does not use resource "units" within the context of the '520 Patent. An ad hoc or arbitrary allocation of resources is antithetical to the concept of "resource units" in the '520 Patent as particular, predefined building blocks of resources.

191. For these reasons, it is my opinion that Chun does not teach or suggest Element 1[a].

8.7.3.1 Element 1 [b]: assigning each RU of the plurality of RUs to a respective station in the plurality of stations, and

192. Dr. Hansen states that Chun teaches Element 1[b]. Hansen Report at ¶¶ 236-39. I disagree.

193. Dr. Hansen cites Chun at ¶¶ [0444], [0446].

[redacted]

194. As I explain above at Element 1[a], Dr. Hansen has not shown that Chun discloses a "plurality of RUs" in a downlink multi-user frame. I incorporate my discussion of Element 1[a] above.

195. Additionally, Dr. Hansen does not explain how Chun discloses "assigning each RU … to a respective station." In my opinion, this is not disclosed by the cited paragraphs.

196. Chun at ¶ [0444] states "the UL MU Trigger frame 2510 may contain control information such as STA ID (identifier)/address information, information on the allocation of resources to be used by each STA, and duration information." This paragraph is not discussing assigning ***downlink*** resource units as required by Element 1[b], but is rather discussing an ***uplink*** "allocation of resources." This is underscored by the following paragraph, Chun at ¶ [0445], which states: "The STA ID/address information refers to information on the identifier or address for specifying an STA that transmits ***uplink*** data." (emphasis added).

197. Chun at ¶ [0446] states "The resource allocation information refers to information on ***uplink*** transmission resources allocated to each STA (e.g., information on frequency/subcarriers allocated to each STA in the case of UL MU OFDMA transmission and a stream index allocated to each STA in the case of UL MU MIMO transmission)." (emphasis added). Again, this passage refers to uplink "transmission resources," and not assigning downlink resource units as required by Element 1[b].

198. For these reasons, it is my opinion that Chun does not teach or suggest Element 1[b].

8.7.3.2 Element 9 [a]: The method of claim 8, wherein the first MPDU is located in a first resource unit of the downlink multi-user frame allocated to the first station,

199. Dr. Hansen states that Chun teaches Element 9[a]. Hansen Report at ¶¶608-09. I disagree.

200. Dr. Hansen exclusively relies on his analysis of Element 1[c] for this element and does not provide any additional analysis.

[redacted]

201. As I explain above at Element 1[a], the cited passages of Chun do not disclose "resource units" in a downlink MU frame, in the context of the '520 claims.

202. As I explain above at Element 1[b], the cited passages of Chun do not disclose "resource units" in a downlink MU frame "allocated to" any stations.

203. I incorporate my analysis of Elements 1[a] and 1[b] above.

204. For these reasons, it is my opinion that Chun does not teach or suggest Element 9[a].

8.7.3.3 Element 9 [b]: wherein the downlink multi-user frame includes a second resource unit that contains a second MPDU that includes acknowledgement information for the second multi-user acknowledgement frame.

205. Dr. Hansen states that Chun teaches Element 9[b]. Hansen Report at ¶¶624-25. I disagree.

206. Dr. Hansen exclusively relies on his analysis of Element 1[d] for this element and does not provide any additional analysis.

207. As I explain above at Element 1[a], the cited passages of Chun do not disclose "resource units" in a downlink MU frame, in the context of the '520 claims.

208. As I explain above at Element 1[b], the cited passages of Chun do not disclose "resource units" in a downlink MU frame "allocated to" any stations.

209. I incorporate my analysis of Elements 1[a] and 1[b] above.

210. For these reasons, it is my opinion that Chun does not teach or suggest Element 9[b].

[redacted]

8.7.4 Shu Fails To Disclose Or Render Obvious Several '520 Claim Limitations

8.7.4.1 Element 1 [a]: generating, by the network device, a downlink multi-user frame addressed to a plurality of stations operating in the wireless network, the downlink multi-user frame including a plurality of resource units (RUs), wherein generating the downlink multi-user frame comprises:

211. Dr. Hansen states that Shu teaches Element 1[a]. Hansen Report at ¶¶210-20. I disagree.

212. Dr. Hansen cites Shu at ¶¶ Abstract, Fig. 3, [0006], [0007], [0020], [0049], [0054], [0056], [0057], [0078].

213. Dr. Hansen does not say what statements in the cited passages he believes disclose the claimed "downlink multi-user frame including a plurality of resource units," and he therefore fails to show that this element is disclosed.

214. As I discuss above in the context of Element 1[a] and Merlin '690, in the '520 Patent, a POSITA would understand the plain and ordinary meaning of "resource units (RUs)" to connote particular units of wireless channel resources. An ad hoc or arbitrary allocation of wireless channel resources is not a "resource unit" in the context of the '520 Patent. Rather, a resource unit must consist of "particular" predefined units of resources. I incorporate that discussion above fully into this section.

215. Shu at ¶ [0054] states "That the access point allocates a channel resource to each station of the multiple stations may be implemented in different manners … The multiple stations may use the OFDMA technology to concurrently send the acknowledgment messages to the access point by using the channel resources allocated by the access point and indicated by the channel resource information…." This paragraph makes clear that the AP is allocating "channel resources" for an ***uplink*** acknowledgement, and is not referring to a "***downlink*** multi-user frame including a plurality of resource units," as required by Element 1[a].

[redacted]

216. Shu at ¶ [0078] states: "That the access point allocates the channel resource to the station may be implemented in different manners … The station sends the acknowledgment message to the access point by using the channel resource allocated by the access point and indicated by the channel resource information." Shu at ¶ [0078] is similar to ¶ [0054] in that both are describing allocating "channel resources" for an ***uplink*** acknowledgement, and not a "***downlink*** multi-user frame including a plurality of resource units," as required by Element 1[a].

217. Shu at ¶ [0051] states "The access point may concurrently send the downlink data frame to each station of the multiple stations by using the multi-user multiple-input multiple-output (Multi-User Multiple-Input Multiple-Output, MU MIMO for short) or orthogonal frequency division multiple access (Orthogonal Frequency Division Multiple Access, OFDMA for short) technology. Alternatively, the access point may sequentially send the corresponding downlink: data frame to each station of the multiple stations."

218. However, this passage does not state that the downlink frame contains "resource units" in the context of the '187 Patent, and does not disclose any particular units of resources. It also does not disclose assigning any downlink resources to stations.

219. For these reasons, it is my opinion that Shu does not teach or suggest Element 1[a].

8.7.4.2 Element 1 [b]: assigning each RU of the plurality of RUs to a respective station in the plurality of stations, and

220. Dr. Hansen states that Shu teaches Element 1[b]. Hansen Report at ¶¶240-43. I disagree.

221. Dr. Hansen cites Shu at ¶¶ [0054], [0078].

222. As I explain above for Element 1[a], Shu at ¶¶ [0054], [0078] does not disclose any ***downlink*** resource units. Rather, these paragraphs are discussing allocating "channel resources" for an ***uplink*** acknowledgement. I incorporate my discussion of Element 1[a] here.

[redacted]

223. Additionally, these passages do not disclose any "assigning" of downlink resource units, because they do not disclose downlink resource units.

224. For these reasons, it is my opinion that Shu does not teach or suggest Element 1[b].

8.7.4.3 Element 1 [c]: including a respective set of MAC Protocol Data Units (MPDUs) in each RU of the plurality of RUs,

225. Dr. Hansen states that Shu teaches Element 1[c]. Hansen Report at ¶¶267-73. I disagree.

226. Dr. Hansen cites Shu at ¶¶ Fig. 7A, [0006], [0032], [0051], [0069].

227. As I explain above for Elements 1[a] and 1[b], these paragraphs do not disclose downlink resource units.

228. Dr. Hansen does not explain why he believes these paragraphs disclose "resource units." None of the cited paragraphs mention "resource units." Paragraph [0006] refers to "acknowledgment messages concurrently sent by the multiple stations on channel resources" and Paragraph [0069] refers to "channel resource that is used to send an acknowledgment message." It is clear that these paragraphs are referring to ***uplink*** "channel resources," not downlink resource units.

229. Dr. Hansen does not explain why he believes these paragraphs disclose "MPDUs." None of the cited paragraphs mention "MPDUs" or "MAC Protocol Data Units." Paragraph [0069] refers to "a Media Access Control-layer frame format of the downlink data frame," but does not say that this is an MPDU, and does not say that this "Media Access Control-layer frame format" is in any way associated with resource units or resources. In particular, the cited paragraphs do not disclose a "respective set of MAC Protocol Data Units (MPDUs) in each RU" in a downlink frame.

230. For these reasons, it is my opinion that Shu does not teach or suggest Element 1[c].

[redacted]

8.7.4.4 Element 1 [g]: wherein the plurality of RUs respectively correspond to a plurality of simultaneous uplink transmissions, and each of the plurality of simultaneous uplink transmissions uses a sub-channel, spatial stream, or sub-channel and spatial stream combination that is not used by any other of the plurality of simultaneous uplink transmissions.

231. Dr. Hansen states that Shu teaches Element 1[g]. Hansen Report at ¶¶371-79. I disagree.

232. Dr. Hansen cites Shu at ¶¶ Fig. 6, [0034], [0060], [0062], [0066], [0097], [0112].

233. As I explain above at Element 1[a] and 1[b], the cited passages of Shu do not disclose the claimed "plurality of RUs" in the downlink multi-user frame. Accordingly, the RUs cannot "respectively correspond to a plurality of simultaneous uplink transmissions" because there are no disclosed downlink RUs that can correspond to the uplink transmissions. I incorporate my discussions of Elements 1[a] and 1[b] here.

234. The cited paragraphs reference "acknowledgment messages concurrently sent by the multiple stations on channel resources allocated by the access point" or use similar language. Shu at ¶¶ [0034], [0060], [0062], [0066], [0097], [0112]. However, these passages do ***not*** say that each node will use a "sub-channel, spatial stream, or sub-channel and spatial stream combination that is not used any other of the plurality of simultaneous uplink transmissions." There is no teaching that the "channel resources" allocated to each node must be unique or different from every other node.

235. For these reasons, it is my opinion that Shu does not teach or suggest Element 1[g].

8.7.4.5 Element 9 [a]: The method of claim 8, wherein the first MPDU is located in a first resource unit of the downlink multi-user frame allocated to the first station,

236. Dr. Hansen states that Shu teaches Element 9[a]. Hansen Report at ¶¶610-15. I disagree.

237. Dr. Hansen relies on his analysis of Element 1[c] for this element.

238. In addition to paragraphs of Shu he cited above for Elements 1[a] and/or 1[c], Dr. Hansen also cites Shu at ¶ [0061]. This paragraph does not mentions MPDUs or resource

[redacted]

units, so it is unclear why he cites it. He provides no analysis of why he believes this paragraph is relevant.

239. As I explain above at Element 1[a], the cited passages of Shu do not disclose "resource units" in a downlink MU frame, in the context of the '520 claims.

240. As I explain above at Element 1[c], the cited passages of Shu do not disclose any MPDUs located in downlink resource units.

241. I incorporate my analysis of Elements 1[a] and 1[c] above.

242. For these reasons, it is my opinion that Shu does not teach or suggest Element 9[a].

8.7.4.6 Element 9 [b]: wherein the downlink multi-user frame includes a second resource unit that contains a second MPDU that includes acknowledgement information for the second multi-user acknowledgement frame.

243. Dr. Hansen states that Shu teaches Element 9[b]. Hansen Report at ¶¶627-28. I disagree.

244. Dr. Hansen exclusively relies on his analysis of Element 1[d] for this element and does not provide any additional citations or analysis.

245. As I explain above at Element 1[a], the cited passages of Shu do not disclose "resource units" in a downlink MU frame, in the context of the '520 claims.

246. As I explain above at Element 1[c], the cited passages of Shu do not disclose any MPDUs located in downlink resource units.

247. I incorporate my analysis of Elements 1[a] and 1[c] above.

248. For these reasons, it is my opinion that Shu does not teach or suggest Element 9[b].

8.7.5 Chu Fails To Disclose Or Render Obvious Several '520 Claim Limitations

[redacted]

8.7.5.1 Element 1 [a]: generating, by the network device, a downlink multi-user frame addressed to a plurality of stations operating in the wireless network, the downlink multi-user frame including a plurality of resource units (RUs), wherein generating the downlink multi-user frame comprises:

249. Dr. Hansen states that Chu teaches Element 1[a]. Hansen Report at ¶¶221-25. I disagree.

250. Dr. Hansen cites Chu at 11:56-63, 12:9-35, Fig. 6.

251. Dr. Hansen does not say what statements in the cited passages he believes disclose the claimed "downlink multi-user frame including a plurality of resource units," and he therefore fails to show that this element is disclosed.

252. As I discuss above in the context of Element 1[a] and Merlin '690, in the '520 Patent, a POSITA would understand the plain and ordinary meaning of "resource units (RUs)" to connote particular units of wireless channel resources. An ad hoc or arbitrary allocation of wireless channel resources is not a "resource unit" in the context of the '520 Patent. Rather, a resource unit must consist of "particular" predefined units of resources. I incorporate that discussion above fully into this section.

253. None of the cited passages mention "resources" or "resource units." Chu at 12:9-35 states in part: "the OFDMA data unit 602 includes a plurality of OFDM data units 604 directed to respective client stations 25, each OFDM data unit 604 transmitted in a respective sub-channel of the WLAN 10 to a particular client station 25 … In an embodiment, the first OFDM data unit 602-1 occupies the highest 20 MHz sub-channel of the 80 MHz channel, the second OFDM data unit 602-3 occupies the second highest 20 MHz sub-channel of the 80 MHz channel, and the third OFDM data unit 602-3 is transmitted in a 40 MHZ sub-channel that includes the lowest two 20 MHz subchannels of the 80 MHz channel."

254. This passage refers to "sub-channels" but does not state that the subchannels are resource units, i.e. "particular" predefined units of resources. Rather, this passage appears

[redacted]

to disclose a system in which the AP specifies sub-channels on an arbitrary or ad hoc basis, which is not the same as the claimed "resource units" in the '520 patent.

255. My opinion is supported by, e.g., Chu at 10:58-63 which states: "In some embodiments, sub-channel allocating with granularity of less than 20 MHz is utilized. For example, the AP 14 is configured to allocate sub-channels having bandwidths less than 20 MHz, such as 10 MHz subchannels, 5 MHz sub-channels, 1 MHz sub-channels, or other suitable bandwidth sub-channels to at least some of the client stations 25." This disclosure makes clear that the sub-channels of Chu can be any "suitable bandwidth" rather than being "particular" resource units. This is antithetical to the concept of "particular" resource units in the '520 Patent that act as predefined building blocks for allocating resources.

256. For these reasons, it is my opinion that Chu does not teach or suggest Element 1[a].

8.7.5.2 Element 1 [b]: assigning each RU of the plurality of RUs to a respective station in the plurality of stations, and

257. Dr. Hansen states that Chu teaches Element 1[b]. Hansen Report at ¶¶244-49. I disagree.

258. Dr. Hansen cites Chu at 7:58-64, 8:4-13.

259. As I explain above at Element 1[a], Dr. Hansen has not shown that Chu teaches or discloses the claimed "RUs" in the context of the '520 Patent. I incorporate my discussion of Element 1[a] here.

260. For these reasons, it is my opinion that Chu does not teach or suggest Element 1[b].

8.7.5.3 Element 1 [d]: wherein an MPDU in one or more of the RUs in the plurality of RUs includes acknowledgement information indicating properties of a multi-user acknowledgement transmission that the station in the plurality of stations to which the RU is assigned is requested to transmit to acknowledge the downlink multi-user frame;

261. Dr. Hansen states that Chu teaches Element 1[d]. Hansen Report at ¶¶299-304. I disagree.

262. Dr. Hansen cites Chu at 12:62-13:10, 13:28-37, 30:21-37, Fig. 14A.

[redacted]

263. As I explain above at Element 1[a], Dr. Hansen has not shown that Chu teaches or discloses the claimed "RUs" in the context of the '520 Patent. I incorporate my discussion of Element 1[a] here.

264. Chu at 12:62-13:10 states "Each of the client stations 25 receives the channel allocation field in the primary channel of the WLAN 10 (e.g., in the lowest 20 MHz channel) and determines, based on the channel allocation field, which channel of the WLAN 10 includes data directed to the client station 25…" This statement is describing a "channel allocation field" that allocates channels in the downlink frame to stations. It does not indicate "properties of a multi-user acknowledgement transmission." Additionally, the cited passage does not say that the "channel allocation field" is located in an MPDU in one or more RUs. Rather, it is located in "the primary channel" and not in any MPDU or any RU addressed "to a respective station."

265. Chu at 13:28-37 describes an embodiment in which "the ACK frames 606 are ***not*** simultaneously transmitted by the client stations 25" (emphasis added). In this embodiment, the "the AP provides to the client stations 25 indications of different specific times at which to transmit their respective ACK frames 606, or a specific order in which to transmit their respective ACK frames 606." *Id.* This cannot be the claimed "acknowledgement information" because it must indicate "properties of a ***multi-user*** acknowledgement transmission." This embodiment in Chu is describing sequential single-user acknowledgements, not a multi-user acknowledgement transmission. Additionally, this text does not disclose any acknowledgement information being located in an MPDU in one or more RUs.

266. Chu at 30:21-37 states in part "a PHY preamble or a MAC header of the OFDM data unit 1406-3, transmitted in the second portion of the second 20 MHz sub-channel includes an indication that an immediate acknowledgement is required for the OFDM data unit 1406-3." This passage does not mention MPDUs or resource units. Moreover, the cited

[redacted]

text of Chu does not say that the "indication" has anything to do with "properties of a ***multi-user*** acknowledgement transmission."

267. For these reasons, it is my opinion that Chu does not teach or suggest Element 1[d].

8.7.5.4 Element 1 [g]: wherein the plurality of RUs respectively correspond to a plurality of simultaneous uplink transmissions, and each of the plurality of simultaneous uplink transmissions uses a sub-channel, spatial stream, or sub-channel and spatial stream combination that is not used by any other of the plurality of simultaneous uplink transmissions.

268. Dr. Hansen states that Chu teaches Element 1[g]. Hansen Report at ¶¶380-83. I disagree.

269. Dr. Hansen cites Chu at 13:3-10, 30:38-44.

270. As I explain above at Element 1[a], Dr. Hansen has not shown that Chu teaches or discloses the claimed "RUs" in the context of the '520 Patent. I incorporate my discussion of Element 1[a] here.

271. Chu at 13:3-10 and 30:38-44 describes a situation where "ACK frames 1408 are transmitted in the respective sub-channels allocated to the client stations." However, neither paragraph states that the "sub-channels" must not be "used by any other of the plurality of simultaneous uplink transmissions." There is no disclosure that the uplink channels must be different or unique from one another. Moreover, there is no discussion of spatial streams in these passages, so there is no disclosure that the uplink transmissions use different spatial streams.

272. For these reasons, it is my opinion that Chu does not teach or suggest Element 1[g].

8.7.5.5 Claim 2: The method of claim 1, wherein generating the downlink multi-user frame further comprises: including the acknowledgement information, for indicating properties of the multi-user acknowledgement transmission transmitted by each respective station in the plurality of stations to acknowledge the downlink multi-user frame, in a header of the one or more MPDUs.

273. Dr. Hansen states that Chu teaches Claim 2. Hansen Report at ¶¶400-03. I disagree.

274. Dr. Hansen cites Chu at 29:37-46.

[redacted]

275. As I explain above at Element 1[d], Dr. Hansen has not shown that Chu discloses MPDUs or discloses the claimed "acknowledgement information." I incorporate my analysis of Element 1[d] here.

276. For these reasons, it is my opinion that Chu does not teach or suggest Claim 2.

8.7.5.6 Claim 4: The method of claim 1, wherein one of the one or more MPDUs in each of the RUs of the plurality of RUs is a unicast trigger frame that contains the acknowledgement information for the respective station in the plurality of stations.

277. Dr. Hansen states that Chu teaches Claim 4. Hansen Report at ¶¶440-44. I disagree.

278. Dr. Hansen cites Chu at 23:57-24:22, and Fig. 11B.

279. As I explain above at Element 1[a], Dr. Hansen has not shown that Chu teaches or discloses the claimed "RUs" in the context of the '520 Patent. I incorporate my discussion of Element 1[a] here.

280. As I explain above at Element 1[d], Dr. Hansen has not shown that Chu discloses MPDUs or discloses the claimed "acknowledgement information." I incorporate my analysis of Element 1[d] here.

281. The cited passages of Chu also do not mention a "unicast trigger frame" or any kind of trigger frame at all. Dr. Hansen does not explain what he contends is the alleged "unicast trigger frame."

282. For these reasons, it is my opinion that Chu does not teach or suggest Claim 4.

8.7.5.7 Element 8[b]. processing a first MAC Protocol Data Units (MPDU) in the downlink multi-user frame to determine acknowledgement information indicating properties of a first multi-user acknowledgement frame;

283. Dr. Hansen states that Chu teaches Element 8[b]. Hansen Report at ¶¶555-57. I disagree.

284. Dr. Hansen cites Chu at 29:37-46.

[redacted]

285. As I explain above at Element 1[d] and Claim 2, Dr. Hansen has not shown that Chu discloses MPDUs or discloses the claimed "acknowledgement information."

286. I incorporate my analysis of Element 1[d] and Claim 2 here.

287. For these reasons, it is my opinion that Chu does not teach or suggest Element 8[b]

8.7.5.8 Element 9 [a]: The method of claim 8, wherein the first MPDU is located in a first resource unit of the downlink multi-user frame allocated to the first station,

288. Dr. Hansen states that Chu teaches Element 9[a]. Hansen Report at ¶¶616-17. I disagree.

289. Dr. Hansen exclusively relies on his analysis of Element 1[c] for this element and does not provide any additional citations or analysis.

290. As I explain above at Element 1[a], the cited passages of Chu do not disclose "resource units" in a downlink MU frame, in the context of the '520 claims.

291. As I explain above at Element 1[d], the cited passages of Chu do not disclose the claimed MPDUs located in downlink resource units.

292. I incorporate my analysis of Elements 1[a] and 1[d] above.

293. For these reasons, it is my opinion that Chu does not teach or suggest Element 9[a].

8.7.5.9 Element 9 [b]: wherein the downlink multi-user frame includes a second resource unit that contains a second MPDU that includes acknowledgement information for the second multi-user acknowledgement frame.

294. Dr. Hansen states that Chu teaches Element 9[b]. Hansen Report at ¶¶629-30. I disagree.

295. Dr. Hansen exclusively relies on his analysis of Element 1[d] for this element and does not provide any additional citations or analysis.

296. As I explain above at Element 1[a], the cited passages of Chu do not disclose "resource units" in a downlink MU frame, in the context of the '520 claims.

297. As I explain above at Element 1[d], the cited passages of Chu do not disclose the claimed MPDUs located in downlink resource units.

[redacted]

298. I incorporate my analysis of Elements 1[a], and 1[d] above.

299. For these reasons, it is my opinion that Chu does not teach or suggest Element 9[b].

8.7.5.10 Claim 11: The method of claim 8, wherein processing the first MPDU comprises: extracting the acknowledgement information indicating the properties of the first multi-user acknowledgement frame from a header of the first MPDU.

300. Dr. Hansen states that Chu teaches Claim 11. Hansen Report at ¶¶659-61. I disagree.

301. Dr. Hansen cites Chu at 29:37-46.

302. As I explain above at Element 1[d] and Claim 2, Dr. Hansen has not shown that Chu discloses MPDUs or discloses the claimed "acknowledgement information."

303. I incorporate my analysis of Element 1[d] and Claim 2 here.

304. For these reasons, it is my opinion that Chu does not teach or suggest Claim 11.

8.7.5.11 Claim 13: The method of claim 8, wherein processing the MPDU comprises: extracting the acknowledgement information indicating the properties of the first multi-user acknowledgement frame transmission from a payload of the first MPDU, wherein the first MPDU is a unicast trigger frame.

305. Dr. Hansen states that Chu teaches Claim 13. Hansen Report at ¶¶681-82. I disagree.

306. Dr. Hansen relies on his analysis of Claims 1, 4, and 8.

307. As I explain above at Claim 4, the cited passages of Chu do not disclose a "unicast trigger frame."

308. I incorporate my analysis of Claim 4 above.

309. For these reasons, it is my opinion that Chu does not teach or suggest Claim 13.

8.7.6 Dr. Hansen's Alleged '520 Prior Art—Even Collectively—Fails To Teach or Suggest Several '520 Claim Limitations, So Any Combination Fails To Render Obvious the '520 Claims

310. This chart summarizes my '520 validity analysis that is detailed above. The rows correspond to a shorthand summary of the '520 claim language, and the columns correspond to Dr. Hansen's five references for the '520 Patent: (1) Merlin '690, (2)

[redacted]

Vermani, (3) Chun, (4) Shu, and (5) Chu. In instances in which I concluded that one of Dr. Hansen's references did not teach or suggest a claim limitation, I placed a red "X" at the row/column intersection. (The absence of a red "X" does not mean that I necessarily agree the reference teaches or suggests the claim limitation). I also identify the references with an X which have not been shown to be prior art to the '520 patent:

'187 Claim Language Shorthand	**Merlin '690**	**Vermani**	**Chun**	**Shu**	**Chu**
Prior Art			**X**		
1[pre] A method for coordinating an UL MU response transmission to a DL MU transmission					
1[a] the downlink multi-user frame including a plurality of RUs	X	X	X	X	X
1[b] assigning each RU to a respective station	X	X	X	X	X
1[c] including MPDUs in each RU	X			X	
1[d] an MPDU in one or more of the RUs includes acknowledgement information	X				X
1[e] transmitting the DL MU frame to the plurality of stations					
1[f] receiving the UL MU response acknowledgements					
1[g] the RUs correspond to the UL transmissions, and each transmission uses a different sub-channel and/or spatial stream		X		X	X
2 including acknowledgement information in a MPDU header					X
3 the header is a MAC header					
4 the MPDU is a unicast trigger frame		X			X
5 the trigger frame instigates each station to transmit the MU acknowledgement after an interframe space					
6 transmitting a MU block acknowledgement request frame following the DL MU frame					
8[pre] A method for transmitting a UL acknowledgment					

[redacted]

‘187 Claim Language Shorthand	Merlin ’690	Vermani	Chun	Shu	Chu
Prior Art			X		
8[a] receiving a DL MU frame addressed to a plurality of stations					
8[b] processing an MPDU in the DL MU frame to determine acknowledgement information					X
8[c] generating the MU acknowledgement frame based on the acknowledgement information					
8[d] transmitting the MU acknowledgment frame					
8[e] two MU acknowledgment frames are transmitted simultaneously					
9[a] MPDU is located in the first DL RU	X	X	X	X	X
9[b] a second MPDU is located in a second DL RU	X	X	X	X	X
10 two MU acknowledgment frames together form a MU acknowledgment frame					
11 extracting acknowledgement information from the MPDU header					X
12 the header is a MAC header					
13 extracting acknowledgement information from the MPDU payload, where the MPDU is a unicast trigger frame		X			X
14 processing a second MPDU in the same RU as the first MPDU					
15 the trigger frame instigates the station to transmit the MU acknowledgement after an interframe space					
16[a] receiving a MU block acknowledgement request frame					
16[b] the MU acknowledgement is transmitted in response to the MU block acknowledgement request frame					
18[pre] A method for transmitting a UL acknowledgment					
18[a] receiving a DL MU frame addressed to a plurality of stations					
18[b] receiving a MU block acknowledgement request frame including acknowledgement information					

[redacted]

‘187 Claim Language Shorthand	Merlin ’690	Vermani	Chun	Shu	Chu
Prior Art			X		
18[c] generating the MU acknowledgement frame based on the acknowledgement information					
18[d] transmitting the MU acknowledgment frame					
18[e] two MU acknowledgment frames are transmitted simultaneously					
19 acknowledgement information includes one or more of (1) MU or SU indication, and (1) resource scheduling					
20[a] acknowledgement information includes properties of the second stations acknowledgement frame					
20[b] two MU acknowledgment frames together form a MU acknowledgment frame					

311. As reflected in the Table above, Dr. Hansen has not clearly shown that any of the asserted references disclose ’520 claim limitations 1[a], 1[b], 9[a], or 9[b]. Consequently, Dr. Hansen’s alleged ’520 prior art—even collectively, or any in combination thereof—fails to teach or suggest every limitation of the ’520 claims. Hence, I understand that Dr. Hansen’s ’520 art cannot, as a matter of law, render obvious claims 1, 9, or any claim that depends from claims 1 or 9.

8.7.7 A POSITA would not have combined Merlin ‘690, Vermani, Chun, Shu, and/or Chu

312. Dr. Hansen discusses why he believes a skilled artisan would have been motivated to combine Merlin ’690, Vermani, Chun, Shu, and Chu. Hansen Report at ¶¶866-875.

313. Dr. Hansen states in ¶ 866 that he believes Merlin ’690, Vermani, Chun, Shu, and Chu are “analogous to the inventions claimed in the ’520 Patent” and “a person of ordinary skill would have had a reasonable expectation of success in combining these references.” Dr. Hansen does not cite any evidence or provide any analysis in support of these opinions.

314. As I show above, Merlin ’690, Vermani, Chun, Shu, and Chu are different from the ’520 Patent in a number of important ways. Likewise, each of these references are different

[redacted]

from one another in important ways, and in each reference Dr. Hansen points to different features as allegedly disclosing the claim elements. For example, each reference discloses different downlink and uplink transmission schemes, different signaling schemes, different signal timing and modulation, and in many cases a feature that is present in one reference will be completely absent from the other references. Dr. Hansen makes no effort to address or reconcile these differences, nor does he explain ***how*** a POSITA would able to successfully combine these references.

315. Dr. Hansen states in ¶ 867 that the references are "analogous art to the claimed invention because the references are from the same field of endeavor as the claimed invention." He does not explain why he believes this to be true and he cites no evidence or analysis in support. He does not even explain what he believes to be the relevant field of endeavor. He also says "Each of these references are analogous art to the claimed invention also because each reference is reasonably pertinent to the problem faced by the inventor." Again he does not explain or justify this statement and does not say what he believes is the problem faced by the inventor. He also says "each of these references would have logically commended themselves to the inventors' attention in considering the problem they were attempting to address." Again, he does not explain or justify this statement and does not say what he believes is the problem being addressed. It appears that ¶887 of Dr. Hansen's report is a recitation of legal boilerplate with no analysis.

316. Dr. Hansen in ¶ 868 block quotes several passages from Merlin '690, and states without explanation that "Merlin '690 discloses teachings, suggestions, and motivations to use the disclosed system." He does not explain why he believes the cited passages support this statement. I disagree that a POSITA would have been motivated to combine Merlin with any of the other references. As I explain above, Merlin '690 is missing many critical claim limitations of the '520 Patent. For example, the '520 Patent allocates downlink resource units, but the authors of Merlin appear to have deliberately designed their system in a way that does not use downlink resource units. A POSITA trying to solve the problems

[redacted]

solved by the ’520 Patent would not be motivated to use Merlin, because Merlin solves a different problem in a different way. Likewise, Merlin does not place MPDUs in resources or resource units. Accordingly, a POSITA trying to design a system like the ’520 Patent that sends DL MU transmissions that include a plurality MPDUs in a plurality of resource units would not look to Merlin ’690, and would instead recognize that Merlin is a different and incompatible system.

317. Dr. Hansen’s statements in ¶ 869 appear to be more legal boilerplate. He states that “it would have been obvious for a POSITA to combine the teachings of any combination of the above references, using known methods as disclosed in the references, to yield predictable results” but he does not explain why he believes this, nor does he explain what the “methods” or “results” would be. In my opinion, Dr. Hansen’s statements in ¶ 869 are unsupported.

318. Dr. Hansen states in ¶ 870 that “it would have been obvious at the time of the invention to combine the teachings of Merlin ’690 with the teachings of Vermani.” I disagree. Dr. Hansen states that both Merlin ’690 and Vermani “independently disclose (or at least render obvious) all asserted claims of the ’520 Patent,” but this is not correct as I explain above. He then states that “both references are directed to similar improvements in IEEE 802.11 WLAN technology” and block quotes various passages from Merlin ’690 and Vermani without explanation. These passages generally say that Merlin and Vermani each “may” relate to various aspects of the 802.11 standard. But many patents reference the 802.11 standard, and mere references to 802.11 does not mean that two patents are compatible or that a POSITA would be motivated to combine them, or even that it would be physically possible to combine them. A search of the PTO database shows that more than 400,000 patents and patent applications mention “802.11.” Moreover, Vermani was filed in 2009 and Merlin in 2014, meaning that different versions of the 802.11 standard were operative at the times these documents were written.

[redacted]

319. Dr. Hansen states in ¶ 871 that "POSITA would have found it obvious to combine Merlin '690 and Vermani such that MU acknowledgement transmissions are made after an interframe spacing period following receipt of the downlink multi-user frame." But, as I explained above, Merlin and Vermani use a different structure for downlink transmissions than is disclosed and claimed in the '520 Patent, one that does not use resource units with embedded MPDUs. As such, any attempt to combine Merlin '690 and Vermani into a system that sends acknowledgements "an interframe spacing period following receipt of the downlink multi-user frame" would result in a different system than the '520 Patent claims, even if such a combination was possible (which Dr. Hansen has not shown or described). Dr. Hansen also states that "both references were assigned to Qualcomm—a company that would have been known to POSITA to be doing work related to IEEE 802.11 technology at the time." But a search of the PTO database shows that Qualcomm has applied for over 40,000 patents, many of which have nothing to do with one another. The mere fact that two patents are assigned to Qualcomm does not provide a reason to combine them, and does not provide any reason to think the combination would be possible or feasible.

320. Dr. Hansen states in ¶ 872 "it would also have been obvious to combine Merlin '690 and/or Vermani with Chun." I disagree. As I explain above, Chun is not prior art and therefore cannot be used in any obviousness combinations. As I further explain above, a POSITA would not combine Merlin '690 and Vermani. Dr. Hansen states "Chun is expressly directed to IEEE 802.11ax—the same standard that the Asserted Patents are allegedly essential to, and Chun provides ample suggestions to use its inventions in that context." He then block quotes various passages from Chun without explanation. But neither Merlin nor Vermani mention 802.11ax, so this cannot provide a reason to combine them with Chun. Instead, Dr. Hansen is impermissibly using hindsight in an unsuccessful attempt to reconstruct the claimed '520 invention, rather than considering what a POSITA at the time would have been motivated to do. He also does not explain how it would be

[redacted]

possible for a POSITA to combine the technically distinct and incompatible systems disclosed in these references with one another.

321. Dr. Hansen states in ¶ 873 it would also have been obvious to combine Merlin ’690 and/or Vermani and/or Chun with Shu.” I disagree. As I explained above, a POSITA would not have combined Merlin ’690, Vermani, and/or Chun, and Chun is not prior art. Dr. Hansen states that “Shu, like Merlin ’690, Vermani, and Chun discussed above, is specifically directed to improvements in IEEE 802.11 WLAN technology” and block quotes various passages of Shu without explanation. This does not provide a basis to combine Shu with the other references. As I note above, hundreds of thousands of patents and patent applications mention “802.11” and many of them discuss unrelated or incompatible technologies. He also does not explain how it would be possible for a POSITA to combine the technically distinct and incompatible systems disclosed in these references with one another.

322. Dr. Hansen states in ¶ 874 “it would also have been obvious to combine Merlin ’690 and/or Vermani and/or Chun and/or Shu with Chu.” I disagree that it would be obvious to combine Merlin ’690 and/or Vermani and/or Chun and/or Shu, for the reasons I explained above. Dr. Hansen’s only reason for adding Shu to the mix is that “Chu specifically discloses that the invention applies to IEEE 802.11ax systems and methods,” followed by various unexplained block quotes from Chu. As I mentioned above, there are hundreds of thousands of patents and patent applications that mention “802.11” and approximately 10,000 of those mention “802.11ax.” The mere reference to these standards does not provide a motivation to combine, and many patents that reference 802.11 disclose unrelated or incompatible technologies. He also does not explain how it would be possible for a POSITA to combine the technically distinct and incompatible systems disclosed in these references with one another.

323. Dr. Hansen states in ¶ 875 “one or more inventors of each of Merlin ’690, Vermani, Chun, and Chu submitted technical papers to the HEW Study Group and IEEE 802.11ax

[redacted]

Task Group. Moreover, inventors of some of these prior art references held technical leadership roles in the TGAX." It is unclear why Dr. Hansen believes this is relevant, and he does not specify which inventors he is talking about. As I note above, many thousands of unrelated patents mention 802.11, or purport to relate to it, or are filed by people who participated in 802.11-related study and task groups. This does not provide a motivation to combine.

324. In sum, Dr. Hansen provides no technical justification for the desirability or feasibility of combining any of the references. His discussions of topics like "802.11" appear to be attempts to use hindsight to justify his preferred combinations. He also does not establish that any such combination, even if possible, would disclose all elements of any claim.

9. THE ART REFERENCED IN THE HANSEN REPORT DOES NOT INVALIDATE THE ASSERTED CLAIMS OF THE '187 PATENT

9.1 Overview of the '187 Patent

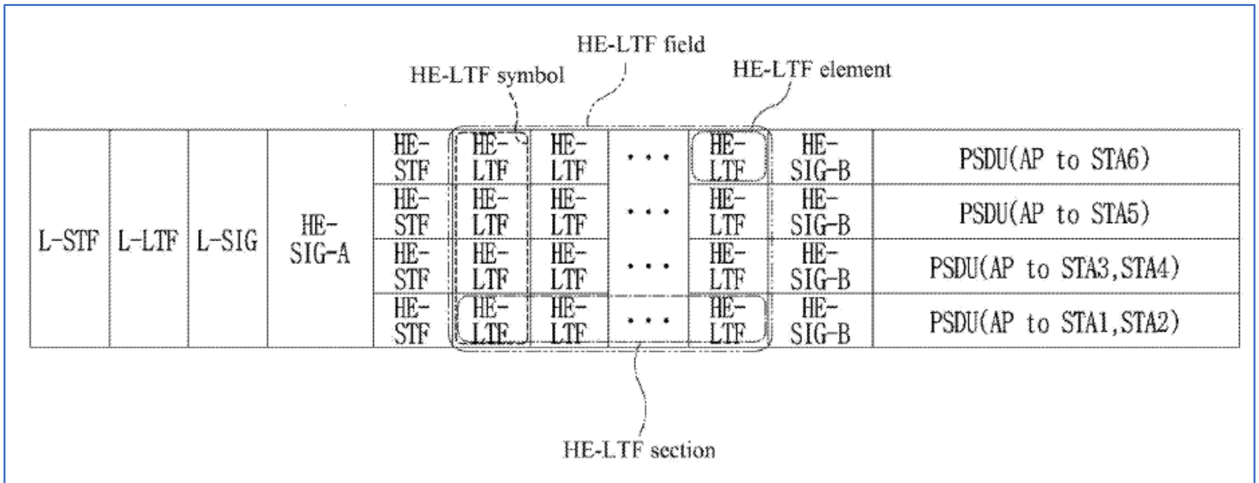
325. The '187 Patent is titled "Interleaver for Physical Layer Protocol Data Unit In a High Efficiency Wireless LAN." '187 Patent (ATLAS-00004262-4296) at Title Page. It was invented by Yongho Seok while working on the next-generation IEEE 802.11ax standard (aka Wi-Fi 6) at Newracom. *Id.*; *see also id.* at 9:45-54. The '187 Patent claims priority to August 11, 2014 and March 18, 2015. *Id*. It issued on December 27, 2016. *Id.*

326. The '187 Patent generally relates to "a method for transmitting data to a plurality of STAs through transmission channel by an AP in a WLAN system, wherein the transmission channel is divided into a plurality of subchannels which are allocated to the plurality of STAs respectively, the method may include interleaving a plurality of data units for the plurality of STAs based on characteristics of the plurality of subchannels allocated to the plurality of STAs to generate a plurality of interleaved data units; and transmitting, through the transmission channel, a Physical layer Protocol Data Unit (PPDU) frame

[redacted]

including the plurality of interleaved data units respectively on the plurality of subchannels to the plurality of STAs." '187 at Abstract.

327. The '187 Patent describes the structure of example MU frames, *e.g.*, as shown in Fig. 7.



328. The '187 Patent explains that different channel sizes may be allocated to different users. "A subchannel allocated to a STA may have a size required for PSDU transmission to the STA. The size of the subchannel allocated to the STA may be N (N=1, 2, 3, ...) times as large as the size of basic subchannel unit (i.e., a subchannel having a minimum size)." *Id.* at 10:9-11.

329. The '187 Patent explains that one of the purposes of the invention "is to provide a new interleaver, an interleaving procedure, a deinterleaver, and a deinterleaving procedure, for application to a High Efficiency WLAN Physical layer Protocol Data Unit (HE PPDU), and to efficiently support Multi-User Multiple Input Multiple Output (MU-MIMO) and Orthogonal Frequency Division Multiple Access (OFDMA) with the HE PPDU." *Id.* at 1:47-53.

330. The '187 Patent describes embodiments of these interleavers and deinterleavers in detail. "The interleaver performs 3-stage permutation. Adjacent coded bits are mapped to non-adjacent subcarriers by the first permutation. Adjacent coded bits are mapped

[redacted]

alternately between less significant bits and more significant bits by the second permutation. Thus, long continuation of less reliable bits may be avoided. The third permutation corresponds to frequency rotation." *Id.* at 22:7-14. "In the HE PPDU frame format, a DATA field (or a PSDU) may be transmitted independently on a subchannel. In this case, processes for PSDU transmission (e.g., encoding, interleaving, padding, modulation, etc. of a PSDU) may be performed independently on a subchannel basis. For example, if interleaving is independently applied to each subchannel, this means that a first interleaver may be used for a first subchannel, a second interleaver may be used for a second subchannel, the first and second subchannels may be different, and the first and second interleavers may be same or different." *Id.* at 22:19-29.

331. The '187 then describes terms and variables relevant to this interleaving and deinterleaving process, and gives examples of values that can be used.

First, parameters are defined, which are used in the following description of an interleaver applied to HE PPDU OFDM symbols supporting MU-MIMO or OFDMA according to the present invention.

N_{CBPS} is the number of coded blocks per symbol.

N_{SS} is the number of spatial streams.

N_{CBPSS} is the number of coded bits per symbol per spatial stream.

N_{CBPSSI} is the number of coded bits per symbol per spatial stream per interleaver block.

N_{ROW} is the number of rows in a block interleaver.

N_{COL} is the number of columns in the block interleaver.

N_{SD} is the number of complex data per frequency segment.

N_{ROT} is a parameter for frequency rotation.

N_{BPSCS} is the number of coded bits per subcarrier per spatial stream.

Id. at 22:54-23:3.

[redacted]

TABLE 3

Parameter	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
N_{SD}	52	54	55	56	56	57
N_{COL}	13	9	11	8	14	19
N_{ROW}	$4 \times N_{BPSCS}(i_{ss})$	$6 \times N_{BPSCS}(i_{ss})$	$5 \times N_{BPSCS}(i_{ss})$	$7 \times N_{BPSCS}(i_{ss})$	$4 \times N_{BPSCS}(i_{ss})$	$3 \times N_{BPSCS}(i_{ss})$
N_{ROT} ($N_{ss} <= 4$)	11	11	11	11	11	11
N_{ROT} ($N_{ss} > 4$)	6	6	6	6	6	6

Parameter	Option 7	Option 8	Option 9	Option 10	Option 11	Option 12
N_{SD}	58	60	60	60	60	60
N_{COL}	29	30	20	15	12	10
N_{ROW}	$2 \times N_{BPSCS}(i_{ss})$	$2 \times N_{BPSCS}(i_{ss})$	$3 \times N_{BPSCS}(i_{ss})$	$4 \times N_{BPSCS}(i_{ss})$	$5 \times N_{BPSCS}(i_{ss})$	$6 \times N_{BPSCS}(i_{ss})$
N_{ROT} ($N_{ss} <= 4$)	11	11	11	11	11	11
N_{ROT} ($N_{ss} > 4$)	6	6	6	6	6	6

Parameter	Option 13	Option 14	Option 15	Option 16	Option 17	Option 18
N_{SD}	62	48	48	48	48	48
N_{COL}	31	16	16	16	16	16
N_{ROW}	$2 \times N_{BPSCS}(i_{ss})$	$3 \times N_{BPSCS}(i_{ss})$	$3 \times N_{BPSCS}(i_{ss})$	$3 \times N_{BPSCS}(i_{ss})$	$3 \times N_{BPSCS}(i_{ss})$	$3 \times N_{BPSCS}(i_{ss})$
N_{ROT} ($N_{ss} <= 4$)	11	10	11	12	13	14
N_{ROT} ($N_{ss} > 4$)	6	4, 5, 6, 7, or 8	4, 5, 6, 7, or 8	4, 5, 6, 7, or 8	4, 5, 6, 7, or 8	4, 5, 6, 7, or 8

Id. at Table 3.

332. The '187 Patent then describes the equations that govern the interleaver permutations.

The first permutation of the interleaver may be expressed as the following [Equation 1].

$$i = N_{ROW}(k \bmod N_{COL}) + \left\lfloor \frac{k}{N_{COL}} \right\rfloor, \quad \text{[Equation 1]}$$

$$k = 0, 1, \ldots, N_{CBPSSI} - 1$$

Id. at Equation 1.

[redacted]

The second permutation of the interleaver is given by the following [Equation 2].

$$j = s\left\lfloor \frac{i}{s} \right\rfloor + \left(i + N_{CBPSSI} - \left\lfloor \frac{N_{COL} \cdot i}{N_{CBPSSI}} \right\rfloor\right) \bmod s, \qquad \text{[Equation 2]}$$

$$i = 0, 1, \ldots , N_{CBPSSI} - 1$$

$$s = \max\left\{1, \frac{N_{BPSCS}}{2}\right\}$$

Id. at Equation 2.

[redacted]

Frequency rotation may be applied of the output of the second permutation (i.e., j). The frequency rotation may be referred to as the third permutation of the interleaver. After the third permutation, the coded bit may be indexed with r.

If $N_{SS}=1$, r=j.

If $2 \leq N_{SS} \leq 4$, the output of the second permutation may be subjected to frequency rotation given by [Equation 3]

$$r = \left\{ j - \left[(2(i_{SS}-1)) \bmod 3 + 3\left\lfloor \frac{i_{SS}-1}{3} \right\rfloor \right] \cdot N_{ROT} \cdot N_{BPSCS} \right\} \bmod N_{CBPSSI}, \quad \text{[Equation 3]}$$

$$j = 0, 1, \ldots, N_{CBPSSI}-1$$

$$i_{SS} = 1, 2, \ldots, N_{SS}$$

In [Equation 3], i_{SS} is the index of a spatial stream on which the interleaver operates.

If $N_{SS}>4$, frequency rotation described by [Equation 4] may be performed on the output of the second permutation.

$$r = \{ j - J(i_{SS}) \cdot N_{ROT} \cdot N_{BPSCS} \} \bmod N_{CBPSSI}, \quad j=0, 1, \ldots, N_{CBPSSI}-1 \quad i_{SS}=1, 2, \ldots, N_{SS} \quad \text{[Equation 4]}$$

In [Equation 4], $J(i_{SS})$ is an integer defined in [Table 4].

TABLE 4

i_{ss}	$J(i_{ss})$
1	0
2	5
3	2
4	7
5	3
6	6
7	1
8	4

Id. at Equations 3 and 4.

333. The ’187 Patent also explains the deinterleaving procedure, which performs the inverse of the above operations. *Id.* at 25:59-26:48.

[redacted]

334. Thus, the ’187 Patent teaches interleaving in the context of MU frames that use OFDMA and/or MU-MIMO. Interleaving is an important feature in the context of Wi-Fi because it significantly reduces errors by “shuffling” or rearranging information in the frame so that pieces of information are spread across the time domain. If a burst error causes a part of the frame to be lost or corrupted, interleaving increases the likelihood that this burst error can be corrected using error correcting codes. Previously, interleaving was limited to OFDM SU frames, but the ’187 Patent teaches how to apply interleaving to MU frames based on the parameters of those MU frames, such that each receiving device can receive and correctly deinterleave the portion of the MU frame intended for it. This enables faster and more reliable MU communications with fewer errors.

9.2 Priority Date

335. The ’187 Patent claims priority to a Korean patent application 10-2014-0103275, filed on August 11, 2014 (“the ‘187 Korean Application”), and provisional application no. 62/135,094, filed on March 18, 2015 (“the ‘187 Provisional Application”):

Related U.S. Application Data

(60) Provisional application No. 62/135,094, filed on Mar. 18, 2015.

(30) **Foreign Application Priority Data**

Aug. 11, 2014 (KR) 10-2014-0103275

ATLAS-00004263.

9.2.1 The ‘187 Korean Application

336. The ‘187 Korean Application (ATLAS-00004552-4601) is titled “INTERLEAVER FOR PHYSICAL LAYER PROTOCOL DATA UNIT IN A HIGH EFFICIENCY WIRELESS LAN 고효율 무선랜의 물리계층 프로토콜 데이터 유닛을 위한 인터리버.”

337. The ’187 Korean Application is written mostly in Korean, which I do not speak. However, the equations and figures from the ’187 Patent that I discussed above are all

[redacted]

present in the ’187 Korean Application, and it is apparent that the ’187 Korean Application discloses the interleaving concepts discussed in the ’187 Patent, for example:

$$i = N_{ROW}(k \bmod N_{COL}) + \left\lfloor \frac{k}{N_{COL}} \right\rfloor, \qquad k = 0, 1, \ldots, N_{CBPSSI} - 1$$

$$j = s\left\lfloor \frac{i}{s} \right\rfloor + \left(i + N_{CBPSSI} - \left\lfloor \frac{N_{COL} \cdot i}{N_{CBPSSI}} \right\rfloor\right) \bmod s, \qquad i = 0, 1, \ldots, N_{CBPSSI} - 1$$

$$s = \max\left\{1, \frac{N_{BPSCS}}{2}\right\}$$

Id. at 5.

$$r = \left\{j - \left[(2(i_{SS} - 1)) \bmod 3 + 3\left\lfloor \frac{i_{SS} - 1}{3} \right\rfloor\right] \cdot N_{ROT} \cdot N_{BPSCS}\right\} \bmod N_{CBPSSI},$$

$$j = 0, 1, \ldots, N_{CBPSSI} - 1$$

$$i_{SS} = 1, 2, \ldots, N_{SS}$$

Id. at 5.

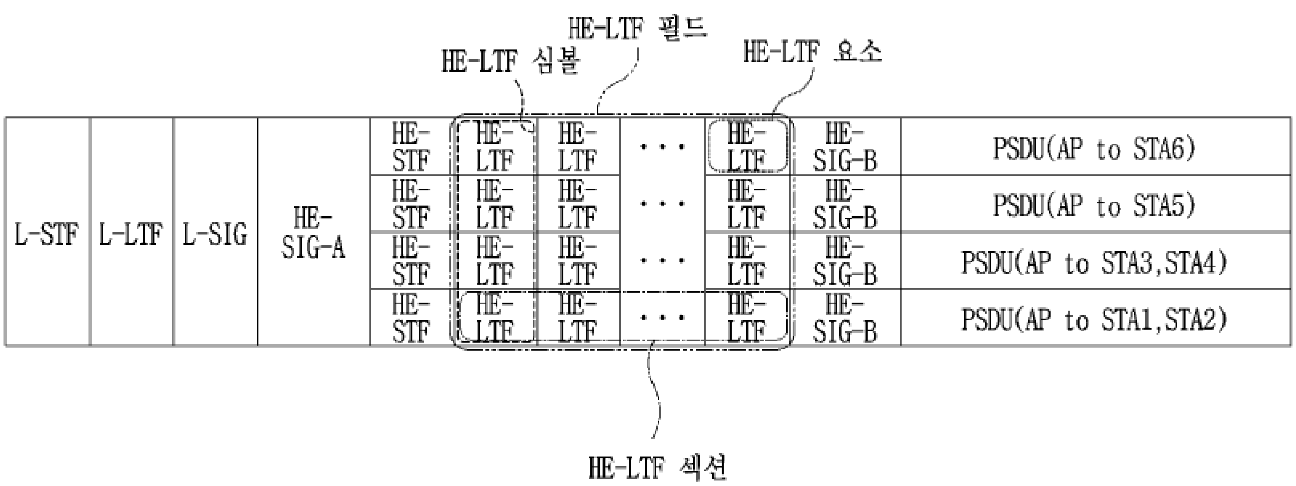
[redacted]

Parameter	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
N_{SD}	52	54	55	56	56	57
N_{COL}	13	9	11	8	14	19
N_{ROW}	$4 \times N_{BPSCS}(i_{ss})$	$6 \times N_{BPSCS}(i_{ss})$	$5 \times N_{BPSCS}(i_{ss})$	$7 \times N_{BPSCS}(i_{ss})$	$4 \times N_{BPSCS}(i_{ss})$	$3 \times N_{BPSCS}(i_{ss})$
N_{ROT} (N_{ss} <=4)	11	11	11	11	11	11
N_{ROT} (N_{ss} >4)	6	6	6	6	6	6

Parameter	Option 7	Option 8	Option 9	Option 10	Option 11	Option 12
N_{SD}	58	60	60	60	60	60
N_{COL}	29	30	20	15	12	10
N_{ROW}	$2 \times N_{BPSCS}(i_{ss})$	$2 \times N_{BPSCS}(i_{ss})$	$3 \times N_{BPSCS}(i_{ss})$	$4 \times N_{BPSCS}(i_{ss})$	$5 \times N_{BPSCS}(i_{ss})$	$6 \times N_{BPSCS}(i_{ss})$
N_{ROT} (N_{ss} <=4)	11	11	11	11	11	11
N_{ROT} (N_{ss} >4)	6	6	6	6	6	6

Parameter	Option 13	Option 14	Option 15	Option 16	Option 17	Option 18
N_{SD}	62	48	48	48	48	48
N_{COL}	31	16	16	16	16	16
N_{ROW}	$2 \times N_{BPSCS}(i_{ss})$	$3 \times N_{BPSCS}(i_{ss})$	$3 \times N_{BPSCS}(i_{ss})$	$3 \times N_{BPSCS}(i_{ss})$	$3 \times N_{BPSCS}(i_{ss})$	$3 \times N_{BPSCS}(i_{ss})$
N_{ROT} (N_{ss} <=4)	11	10	11	12	13	14
N_{ROT} (N_{ss} >4)	6	4, 5, 6, 7, or 8	4, 5, 6, 7, or 8	4, 5, 6, 7, or 8	4, 5, 6, 7, or 8	4, 5, 6, 7, or 8

Id. at 26.



[redacted]

Id. at 43.

338. The Korean patent office, KIPO, offers a machine translation of the ’187 Korean Application on its website. That machine translation also confirms that the ’187 Korean application supports the teachings of the of the ’187 Patent. For example, the machine translation of the Abstract is as follows: “The invention relates to the interleaver applied to the physical layer protocol data unit (PPDU) on the high efficiency wireless LAN and transmission method and apparatus for using the same. In the method for the wireless LAN-system transmitting data with AP to multiple STAs through the transmission channel according to one aspect of the present invention, it is divided into multiple sub channels in which the transmission channel is allocated to multiple STAs. And a method may include the step of interleaving the multiple data units for the multiple STAs based on the property of the multiple sub channels allocated in multiple STAs and producing multiple interleaved data units, and the step of transmitting the PPDU frame including the multiple interleaved data units in the multiple sub channels with multiple STAs through the transmission channel.”

339. Based at least on the foregoing citations and figures, it is my opinion that the ’187 claims are likely supported by the ’187 Korean Application.

340. I further note that the cover letter of the ’187 Provisional Application (which I discuss below), characterizes it as an “English-translated specification.” ATLAS-00004490. This strongly suggests that all of the disclosures in the ’187 Provisional Application are also present in the ’187 Korean Application, because it is a translation of the ’187 Korean Application.

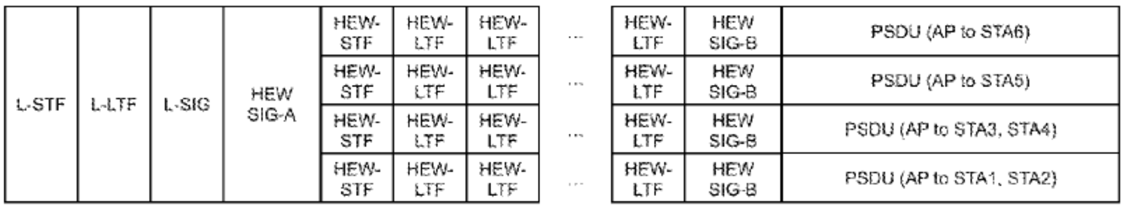
9.2.2 The ‘187 Provisional Application

341. The ‘187 Provisional Application (ATLAS-00004490-4549) is titled “Interleaver for HEW PPDU.”

[redacted]

342. The ’187 Provisional teaches how to interleave and deinterleave 802.11ax MU frames that use OFDMA and/or MU-MIMO. The ’187 Provisional includes multiple diagrams and descriptions of MU frames and their contents, for example:

> The present invention relates to an IEEE 802.11ax High Efficiency WLAN (HEW) PPDU format, which operates in 2.4 GHz and 5 GHz bands. The HEW PPDU format proposed in the present invention supports Multi-User (MU) Multiple-Input and Multiple-Output (MIMO) technology, and also supports Orthogonal Frequency Division Multiple Access (OFDMA) technology. In particular, the present invention proposes an interleaver for each OFDM symbols in HEW PPDU.
>
> The following figure shows the HEW PPDP format proposed in the present invention.



Id. at 6.

343. The ’187 Provisional describes the interleaver and deinterleaver for MU frames in detail, including the same equations 1, 2, and 3 disclosed in the ’187 Patent.

> The interleaving is defined using three permutations. The first permutation is given by the rule shown in Equations 1.
>
> $$i = N_{ROW}(k \bmod N_{COL}) + \left\lfloor \frac{k}{N_{COL}} \right\rfloor, k = 0, 1, \ldots, N_{CBPSSI} - 1$$
>
> where
>
> $\lfloor x \rfloor$ is defined in 1.5 (Mathematical Usage) … Equation 1
>
> Note- N_{CBPSSI} is the number of coded bits per symbol per spatial stream per BCC interleaver block.

Id. at 11.

[redacted]

The second permutation is defined by the rule shown in Equation 2.

$$j = s\left\lfloor \frac{i}{s} \right\rfloor + \left(i + N_{CBPSSI} - \left\lfloor \frac{N_{COL} \cdot i}{N_{CBPSSI}} \right\rfloor\right) \bmod s, \quad i = 0, 1, \ldots, N_{CBPSSI} - 1$$

… Equation 2

where s is defined as $s = \max\left\{1, \frac{N_{BPSCS}}{2}\right\}$

Note- N_{BPSCS} is the number of coded bits per subcarrier per spatial stream.

Id. at 11.

If 2 <= N_{ss} <= 4, a frequency rotation is applied to the output of the second permutation as shown in Equation 3.

$$r = \left\{ j - \left[(2(i_{SS} - 1)) \bmod 3 + 3\left\lfloor \frac{i_{SS} - 1}{3} \right\rfloor \right] \cdot N_{ROT} \cdot N_{BPSCS} \right\} \bmod N_{CBPSSI}$$

$$j = 0, 1, \ldots N_{CBPSSI} - 1$$

where

$i_{SS} = 1, 2, \ldots, N_{SS}$ is the spatial steam index on which this interleaver is operating

… Equation 3

Id. at 11.

[redacted]

If $N_{ss} > 4$, a frequency rotation is applied to the output of the second permutation as shown in Equation 4.

$$r = \{j - J(i_{SS}) \cdot N_{ROT} \cdot N_{BPSCS}\} \bmod N_{CBPSSI}, j = 0, 1, \ldots, N_{CBPSSI} - 1$$

… Equation 4

where i_{ss}= 1, 2, …, N_{ss} is the spatial steam index on which this interleaver is operating, and $J(i_{ss})$ is an integer as defined in Table 1.

Table 1 - $J(i_{ss})$ values

i_{SS}	$J(i_{SS})$
1	0
2	5
3	2
4	7
5	3
6	6
7	1
8	4

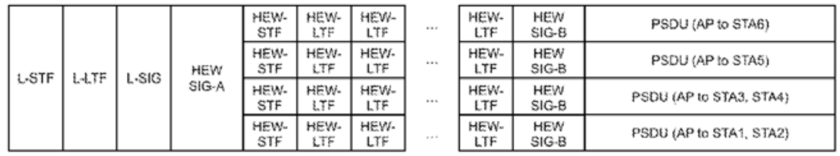
Id. at 11-12.

344. The '187 Application also describes the deinterleaving procedure. *Id.* at 12-13.

345. Based at least on the foregoing citations and figures, it is my opinion that the '187 claims are supported by the '187 Provisional Application. I provide examples below of statements in the '187 Provisional Application that provide written description support for asserted claims:

Claim 1	**'187 Provisional App**
1[A]. A method for transmitting data to a plurality of Stations (STAs) through a transmission channel by an Access Point (AP) in a Wireless Local Area Network (WLAN) system, wherein the transmission	"The present invention relates to an IEEE 802.1 lax High Efficiency WLAN (HEW) PPDU format, which operates in 2.4 GHz and 5 GHz bands. The HEW PPDU format proposed in the present invention supports Multi-User (MU) Multiple-Input and Multiple-Output (MIMO) technology, and also supports Orthogonal Frequency Division Multiple Access (OFDMA) technology. In particular, the present invention proposes an interleaver for each OFDM symbols in HEW PPDU. The

[redacted]

channel is divided into a plurality of resource units which are allocated to the plurality of STAs respectively, the method comprising:	following figure shows the HEW PPDP format proposed in the present invention." *Id.* at 6.  *Id.* at 6. "The sub-channel information allocated to each HEW STA is configured by including a group ID and NBw in the HEW SIG-A field. When each HEW STA accesses the HEW AP, the HEW AP allocates a group ID and the STA position information of the corresponding HEW STA for the group ID to the HEW STA." *Id.* at 7. "In a HEW PPDU, a PSDU may be transmitted independently on a sub-channel basis. In this case, the PSD may be encoded, interleaved, padded, and modulated independently on a sub-channel basis. In the case here a PSDU is transmitted using 256 FFT in the HEW PPDU, if PSDUs are transmitted independently on 8 subchannels, one sub-channel has 32 FFT, that is, up to 32 sub-carriers. If PSDUs are transmitted independently on 4 sub-channels, one sub-channel has 64 FFT, that is, up to 64 sub-carriers. If PSDU s are transmitted independently on 2 sub-channels, one sub-channel has 128 FFT, that is, up to 128 sub-carriers. If 256 FFT is used for transmission of a PSDU to one destination STA without a distinction made between sub-channels, the PSDU has up to 256 sub-carriers per OFDM symbol." *Id.* at 10.
1[B]. interleaving a plurality of data units for the plurality of STAs based on sizes of the plurality of resource units allocated to the plurality of STAs to generate a plurality of interleaved data units; and	*See* disclosures cited above for 1[A]. "In a HEW PPDU, a PSDU may be transmitted independently on a sub-channel basis. In this case, the PSD may be encoded, interleaved, padded, and modulated independently on a sub-channel basis. In the case here a PSDU is transmitted using 256 FFT in the HEW PPDU, if PSDUs are transmitted independently on 8 subchannels, one sub-channel has 32 FFT, that is, up to 32 sub-carriers. If PSDUs are transmitted independently on 4 sub-channels, one sub-channel has 64 FFT, that is, up to 64 sub-carriers. If PSDU s are transmitted independently on 2 sub-channels, one sub-channel has 128 FFT, that is, up to 128 sub-carriers. If 256 FFT is used for transmission of a PSDU to one destination STA without a distinction made between sub-

[redacted]

	channels, the PSDU has up to 256 sub-carriers per OFDM symbol." *Id.* at 10. "If a PSDU is transmitted independently on one sub-channel, the present invention proposes the following configuration of data, pilots, and guard sub-carriers and the following interleaver for data sub-carriers, regarding 256 sub-carriers corresponding to one sub-channel." *Id.* at 10; *see also id.* at 10-13 (describing example interleaver and deinterleaver for RU with size 256). "If PSDUs are transmitted independently on two sub-channels, the present invention proposes the following configuration of data, pilots, and guard sub-carriers and the following interleaver for data sub-carriers, regarding for 128 sub-carriers corresponding to one sub-channel." *Id.* at 13; *see also id.* at 13-16 (describing example interleaver and deinterleaver for RU with size 128). "If PSDU s are transmitted independently on four sub-channels, the present invention proposes the following configuration of data, pilots, and guard sub-carriers and the following interleaver for data sub-carriers, regarding 64 sub-carriers corresponding to one sub-channel." *Id.* at 16; *see also id.* at 16-19 (describing example interleaver and deinterleaver for RU with size 64). "If PSDUs are transmitted independently on 8 sub-channels, the present invention proposes the following configuration of data, pilots, and guard sub-carriers and the following interleaver for data sub-carriers, regarding 32 sub-carriers corresponding to one sub-channel." *Id.* at 19; *see also id.* at 19-20 (describing example interleaver and deinterleaver for RU with size 32). "In a HEW PPDU, a PSDU may be transmitted independently on a sub-channel basis. The channel bandwidth of each sub-channel may be 2.5MHz, 5MHz, 10MHz, 20MHz, 40MHz, or 80MHz. For example, PSDUs are transmitted simultaneously to four STAs using 256 FFT on a 20-MHz channel. In this case, the channel bandwidths of PSDUs directed to 4 STAs may be different, 2.5MHz, 2.5MHz, 5MHz, and 10MHz. The channel bandwidth of a PSDU transmitted on each sub-channel may be different in a HEW PPDU. To support this, an interleaver used for PSDU transmission on a sub-channel basis may operate independently using different interleaver depths (N_{COL}) and N_{ROW} values." *Id.* at 20.

[redacted]

1[C]. transmitting, through the transmission channel, a Physical layer Protocol Data Unit (PPDU) frame including the plurality of interleaved data units respectively on the plurality of resource units to the plurality of STAs,	*See* disclosures cited above for 1[A] and 1[B]. *See also id.* at 2-4 (describing transmission signal processing) "In a HEW PPDU, a PSDU may be transmitted independently on a sub-channel basis. The channel bandwidth of each sub-channel may be 2.5MHz, 5MHz, 10MHz, 20MHz, 40MHz, or 80MHz. For example, PSDUs are transmitted simultaneously to four STAs using 256 FFT on a 20-MHz channel. In this case, the channel bandwidths of PSDUs directed to 4 STAs may be different, 2.5MHz, 2.5MHz, 5MHz, and 10MHz. The channel bandwidth of a PSDU transmitted on each sub-channel may be different in a HEW PPDU. To support this, an interleaver used for PSDU transmission on a sub-channel basis may operate independently using different interleaver depths (N_{COL}) and N_{ROW} values." *Id.* at 20.
1[D]. wherein a set of sizes available to a resource unit allocated to a first STA among the plurality of STAs includes a first size and a second size,	*See* disclosures cited above for 1[A] and 1[B]. As shown above at 1[B], the provisional discloses at least four examples of available resource unit sizes that can be allocated to a first STA: 256 sub-carriers (20MHz), 128 sub-carriers (10MHz), 64 sub-carriers (5MHz), and 32 sub-carriers (2.5MHz). For purposes of this analysis, 128 sub-carriers (10MHz) can be considered to be the "first size" and 52 sub-carriers (5MHz) can be considered to be the "second size."
1[E]. wherein the interleaving of the plurality of data units for the plurality of STAs comprises:	*See* disclosures cited above for 1[B].
1[F]. when the size of the resource unit allocated to the first STA is the first size, interleaving a data unit for the first STA using a first set of interleaving parameter values; and	"If PSDUs are transmitted independently on two sub-channels, the present invention proposes the following configuration of data, pilots, and guard sub-carriers and the following interleaver for data sub-carriers, regarding for 128 sub-carriers corresponding to one sub-channel." *Id.* at 13; *see also id.* at 13-16 (describing example interleaver and deinterleaver for RU with size 128). "The interleaver may be configured to perform frequency interleaving. The stream parser may output blocks of N_{CBPSSI} bits. Each block may then be interleaved by the interleaver that writes to rows and reads out columns. The number of columns N_{COL} or

[redacted]

interleaver depth, may be chosen to optimize the ability to recover errors for the particular bandwidth and frequencies used. In one embodiment, 10 MHz OFDM-MIMO transmission may be used. Within 10 MHz, 128 orthogonal subcarriers may be available. In one aspect, out of the 128 possible subcarriers, 102 subcarriers (i.e., tones) may be used to transmit data while the remaining tones may be used for pilot tones, a DC tone, and guard tones. As such, the interleaver depth N_{COL} may be optimized for 102 data tones according to various embodiments. In one aspect, the interleaver depth N_{COL} may be chosen to be a factor of the number of data tones (i.e., 102). The selected depth N_{COL} may be chosen based on which depth provides the best frequency diversity over the 102 data tones io be able to recover the message at the receiver." *Id.* at 13.

The below table shows the proposed parameters for interleaver depth (NCOL) and N_{ROW}.

Parameter	
N_{SD}	102
N_{COL}	17
N_{ROW}	6 x $N_{BPSCS}(i_{ss})$
N_{ROT} (N_{ss} <=4)	23 or 24 or 25 or 26 or 27
N_{ROT} (N_{ss} >4)	10 or 11 or 12 or 13 or 14

Id. at 13-14.

1[G]. when the size of the resource unit allocated to the first STA is the second size, interleaving the data unit for the first STA using a second set of interleaving parameter values, and	"If PSDU s are transmitted independently on four sub-channels, the present invention proposes the following configuration of data, pilots, and guard sub-carriers and the following interleaver for data sub-carriers, regarding 64 sub-carriers corresponding to one sub-channel." *Id.* at 16; *see also id.* at 16-19 (describing example interleaver and deinterleaver for RU with size 64). "The interleaver may be configured to perform frequency interleaving. The stream parser may output blocks of N_{CBPSSI} bits. Each block may then be interleaved by the interleaver that writes to rows and reads out columns. The number of columns N_{COL} or interleaver depth, may be chosen to optimize the ability to recover errors for the particular bandwidth and frequencies used. In one embodiment, 5 MHz OFDM-MIMO transmission may be used. Within 5 MHz, 64 orthogonal subcarriers may be available.

[redacted]

In one aspect, out of the 64 possible subcarriers, 48 subcarriers (i.e., tones) may be used to transmit data while the remaining tones may be used for pilot tones, a DC tone, and guard tones. As such, the interleaver depth N_{COL} may be optimized for 48 data tones according to various embodiments. In one aspect, the interleaver depth N_{COL} may be chosen to be a factor of the number of data tones (i.e., 48). The selected depth N_{COL} may be chosen based on which depth provides the best frequency diversity over the 48 data tones io be able to recover the message at the receiver." *Id.* at 16-17.

The below table shows the proposed parameters for interleaver depth (NCOL) and N_{ROW}.

Parameter	
N_{SD}	48
N_{COL}	16
N_{ROW}	$3 \times N_{BPSCS}(i_{ss})$
N_{ROT} (N_{ss} <=4)	10 or 11 or 12 or 13 or 14
N_{ROT} (N_{ss} >4)	4 or 5 or 6 or 7 or 8

Id. at 17.

1[H]. wherein the first size is smaller than a size of the transmission channel, the second size is smaller than the first size, and the second set of interleaving parameter values is different from the first set of interleaving parameter value.	As shown above: The first size (128 sub-carriers, 10MHz) is smaller than the transmission channel (256 sub-carriers, 20MHz). The second size (64 sub-carriers, 5MHz) is smaller than the first size (128 sub-carriers, 10MHz). The second set of interleaving parameter values is different from the first set of interleaving parameter values:

[redacted]

The below table shows the proposed parameters for interleaver depth (NCOL) and N_{ROW}.

Parameter	
N_{SD}	102
N_{COL}	17
N_{ROW}	6 x $N_{BPSCS}(i_{ss})$
N_{ROT} (N_{ss} <=4)	23 or 24 or 25 or 26 or 27
N_{ROT} (N_{ss} >4)	10 or 11 or 12 or 13 or 14

Id. at 13-14 (first set of parameter values).

The below table shows the proposed parameters for interleaver depth (NCOL) and N_{ROW}.

Parameter	
N_{SD}	48
N_{COL}	16
N_{ROW}	3 x $N_{BPSCS}(i_{ss})$
N_{ROT} (N_{ss} <=4)	10 or 11 or 12 or 13 or 14
N_{ROT} (N_{ss} >4)	4 or 5 or 6 or 7 or 8

Id. at 17 (second set of parameter values).

Claim 2	**'187 Provisional App**
2. The method according to claim 1, wherein a size of each of the plurality of resource units corresponds to a number of tones allocated to said each of the plurality of resource units.	As shown above, each of the plurality of resource units correspond to a number of tones allocated to said resource unit: 256 sub-carriers (20MHz), 128 sub-carriers (10MHz), 64 sub-carriers (5MHz), and 32 sub-carriers (2.5MHz).

Claim 3	**'187 Provisional App**
3. The method according to claim 2, wherein the number of tones allocated to said each of the plurality of resource units includes a number of tones used for complex data and a	*See* disclosures cited above for [1] and [2]. "… out of the 128 possible subcarriers, 102 subcarriers (i.e., tones) may be used to transmit

[redacted]

number of tones used for pilot in said each of the plurality of resource units.	data while the remaining tones may be used for pilot tones, a DC tone, and guard tones." *Id.* at 13. "…out of the 64 possible subcarriers, 48 subcarriers (i.e., tones) may be used to transmit data while the remaining tones may be used for pilot tones, a DC tone, and guard tones." *Id.* at 16. "

Claim 4	**'187 Provisional App**
4[A]. The method according to claim 1, wherein the set of sizes available to the resource unit allocated to the first STA among the plurality of STAs further includes a third size,	*See* disclosures cited above for [1]. For purposes of this analysis, 32 sub-carriers (2.5MHz) can be considered to be the "third size."
[4B]. wherein the interleaving of the plurality of data units for the plurality of STAs further comprises:	*See* disclosures cited above for 1[B].
[4C]. when the size of the resource unit allocated to the first STA is the third size, interleaving the data unit for the first STA using a third set of interleaving parameter values, and	"If PSDUs are transmitted independently on 8 sub-channels, the present invention proposes the following configuration of data, pilots, and guard sub-carriers and the following interleaver for data sub-carriers, regarding 32 sub-carriers corresponding to one sub-channel." *Id.* at 19; *see also id.* at 19-20 (describing example interleaver and deinterleaver for RU with size 32). "The interleaver may be configured to perform frequency interleaving. The stream parser may output blocks of N_{CBPSSI} bits. Each block may then be interleaved by the interleaver that writes to rows and reads out columns. The number of columns N_{COL} or interleaver depth, may be chosen to optimize the ability to recover errors for the particular bandwidth and frequencies used. In one embodiment, 2.5 MHz OFDM-MIMO transmission may be used. Within 2.5 MHz, 32 orthogonal subcarriers may be available. In one aspect, out of the 32 possible subcarriers, 24 subcarriers (i.e., tones) may be used to transmit data while the remaining tones may be used for pilot tones, a DC tone, and guard tones. As such, the interleaver depth N_{COL} may be optimized for 24 data tones according to

[redacted]

<table>
<tr>
<td></td>
<td>various embodiments. In one aspect, the interleaver depth N_{COL} may be chosen to be a factor of the number of data tones (i.e., 24). The selected depth N_{COL} may be chosen based on which depth provides the best frequency diversity over the 24 data tones io be able to recover the message at the receiver.” Id. at 20.

The below table shows the proposed parameters for interleaver depth (NCOL) and N_{ROW}.
<table>
<tr><td>Parameter</td><td></td></tr>
<tr><td>N_{SD}</td><td>24</td></tr>
<tr><td>N_{COL}</td><td>8</td></tr>
<tr><td>N_{ROW}</td><td>3 x $N_{BPSCS}(i_{ss})$</td></tr>
<tr><td>N_{ROT} (N_{ss} <=4)</td><td>5 or 6 or 7 or 8</td></tr>
<tr><td>N_{ROT} (N_{ss} >4)</td><td>2 or 3 or 4</td></tr>
</table>
Id. at 20.</td>
</tr>
<tr>
<td>[4D]. wherein the third size is smaller than the second size, and the third set of interleaving parameter values is different from the second set of interleaving parameter values.</td>
<td>As shown above:

The third size (32 sub-carriers, 2.5MHz) is smaller than the second size (64 sub-carriers, 5MHz).

The third set of interleaving parameter values is different from the second set of interleaving parameter values:

The below table shows the proposed parameters for interleaver depth (NCOL) and N_{ROW}.
<table>
<tr><td>Parameter</td><td></td></tr>
<tr><td>N_{SD}</td><td>48</td></tr>
<tr><td>N_{COL}</td><td>16</td></tr>
<tr><td>N_{ROW}</td><td>3 x $N_{BPSCS}(i_{ss})$</td></tr>
<tr><td>N_{ROT} (N_{ss} <=4)</td><td>10 or 11 or 12 or 13 or 14</td></tr>
<tr><td>N_{ROT} (N_{ss} >4)</td><td>4 or 5 or 6 or 7 or 8</td></tr>
</table>
Id. at 17 (second set of parameter values).</td>
</tr>
</table>

[redacted]

The below table shows the proposed parameters for interleaver depth (NCOL) and N_{ROW}.

Parameter	
N_{SD}	24
N_{COL}	8
N_{ROW}	3 x $N_{BPSCS}(i_{ss})$
N_{ROT} (N_{ss} <=4)	5 or 6 or 7 or 8
N_{ROT} (N_{ss} >4)	2 or 3 or 4

Id. at 20.

Claim 5	’187 Provisional App
5. The method according to claim 1, wherein an interleaver depth for the first set of interleaving parameter values is different from an interleaver depth for the second set of interleaving parameter values.	*See* disclosures cited above for [1]. As shown above, the interleaver depth is referred to as N_{COL}. In the examples shown above, the interleaver depth for the first set of interleaving parameters is 17, and the interleaver depth for the second set of interleaving parameters is 16.

Claim 6	’187 Provisional App
6. The method according to claim 1, wherein each of the first set of interleaving parameter values and the second set of interleaving parameter values includes the number NCOL of columns in a block interleaver, the number NROW of rows in the block interleaver, and a frequency rotation parameter NROT.	*See* disclosures cited above for [1]. As shown above, the first and second set of interleaving parameter values includes N_{COL}, N_{ROW}, and N_{ROT}.

Claim 7	’187 Provisional App
7. The method according to claim 1, wherein the interleaving of the plurality of data units for the plurality of STAs comprises: when the size of the resource unit allocated to the first STA is 24 data tones,	*See* disclosures cited above for [1], [4]. As shown above, when the size of the resource unit is 24 data tones, the number of columns is 8:

[redacted]

<table>
<tr>
<td>interleaving the data unit for the first STA using a block interleaver having 8 columns.</td>
<td>The below table shows the proposed parameters for interleaver depth (NCOL) and N_{ROW}.
<table>
<tr><td>Parameter</td><td></td></tr>
<tr><td>N_{SD}</td><td>24</td></tr>
<tr><td>N_{COL}</td><td>8</td></tr>
<tr><td>N_{ROW}</td><td>3 x $N_{BPSCS}(i_{ss})$</td></tr>
<tr><td>N_{ROT}
(N_{ss} <=4)</td><td>5 or 6 or 7 or 8</td></tr>
<tr><td>N_{ROT}
(N_{ss} >4)</td><td>2 or 3 or 4</td></tr>
</table>
Id. at 20.</td>
</tr>
</table>

Claim 8	'187 Provisional App
8[A]. The method according to claim 1, wherein:	*See* disclosures cited above for [1].
[8B] when an index of a bit input for interleaving is k, an index i and an index j are calculated by the following equations, $i = N_{ROW}(k \bmod N_{COL}) + \left\lfloor \frac{k}{N_{COL}} \right\rfloor, k = 0, 1, \ldots, N_{CBPSSI} - 1$ $j = s\left\lfloor \frac{i}{s} \right\rfloor + \left(i + N_{CBPSSI} - \left\lfloor \frac{N_{COL} \cdot i}{N_{CBPSSI}} \right\rfloor\right) \bmod s,$ $i = 0, 1, \ldots, N_{CBPSSI} - 1$ $s = \max\left\{1, \frac{N_{BPSCS}}{2}\right\}$ i is an index obtained by applying a first permutation to the index k, j is an index obtained by applying a second permutation to the index i,	Each of the equations listed in the left column is reproduced and described in the '187 Provisional. They are labeled as "Equation 1" and "Equation 2." *See id.* at 11, 14, 17.
[8C] when a number of spatial streams NSS=is 1, an index r obtained by frequency rotation is calculated by r=j, and	As shown in the '187 Provisional, when NSS = 1, no rotation is performed, and therefore r = j. *Id.* at 11-12, 14-15, 18.
[8D] when 2≦NSS≦4, the index r is calculated by $r = \left\{j - \left[(2(i_{SS} - 1)) \bmod 3 + 3\left\lfloor \frac{i_{SS} - 1}{3} \right\rfloor\right] \cdot N_{ROT} \cdot N_{BPSCS}\right\} \bmod N_{CBPSSI},$ $j = 0, 1, \ldots, N_{CBPSSI} - 1$ $i_{SS} = 1, 2, \ldots, N_{SS}$ where: mod represents a modulo operation, $\lfloor\ \rfloor$ is a floor operation, NCOL is a number of columns in a block interleaver, NROW is a number of rows in the block interleaver, NROT	This equation, which is used when 2≦NSS≦4, is disclosed in the '187 Provisional as "Equation 3." *Id.* at 11, 15, 18.

[redacted]

is a frequency rotation parameter, and NCBPSSI is the number of coded bits per symbol per spatial stream per interleaver block.	

Claim 9	**'187 Provisional App**
9. The method according to claim 8, wherein NSS is set to separate values for the plurality of resource units.	*See* disclosures cited above for [1], [8]. The number of spatial streams, NSS, may have different values for each resource unit transmitted to each STA. "...information about the numbers of spatial streams to be transmitted to HEW STAs that are allocated to respective sub-channels may be included in the HEW SIG-A field." *Id.* at 8. "In the case of MU-MIMO, different numbers of spatial streams may be transmitted to multiple HEW STAs, which are destination terminals of MU-MIMO transmission." *Id.* at 9.

Claim 10	**'187 Provisional App**
10[A]. A method for receiving data from an Access Point (AP) through a transmission channel by a first Station (STA) among a plurality of STAs in a Wireless Local Area Network (WLAN) system, wherein the transmission channel is divided into a plurality of resource units which are allocated to the plurality of STAs respectively, the method comprising:	*See* disclosures cited above for 1[A]. *See also id.* at 4 (describing receiver signal processing).
[10B] receiving, through the transmission channel, a Physical layer Protocol Data Unit (PPDU) frame including a plurality of data units for the plurality of STAs respectively on the plurality of resource units to acquire a data unit for the first STA from a resource units allocated to the first STA; and	*See* disclosures cited above for 1[B] and 1[C]. *See also id.* at 4 (describing receiver signal processing).
[10C] deinterleaving the data unit for the first STA based on a size corresponding to the resource unit allocated to the first STA,	*See* disclosures cited above for 1[B]. "The deinterleaver 250 deinterleaves the bits of each stream output from the demapper 240." *Id.* at 4.

[redacted]

[10D] wherein a set of sizes available to the resource unit allocated to the first STA includes a first size and a second size,	*See* disclosures cited above for 1[D].
[10E] wherein the deinterleaving of the data unit for the STA comprises:	*See* disclosures cited above for 1[E].
10[F]. when the size of resource unit allocated to the first STA is the first size, deinterleaving the data unit for the first STA using a first set of interleaving parameter values; and	*See* disclosures cited above for 1[F]. "The deinterleaver uses the following three operations to perform the inverse permutations." *Id.* at 15-16 (describing deinterleaver for 128 sub-channel RU).
10[G]. when the size of resource unit allocated to the first STA is the second size, deinterleaving the data unit for the first STA using a second set of interleaving parameter values; and	*See* disclosures cited above for 1[G]. "The deinterleaver uses the following three operations to perform the inverse permutations." *Id.* at 18-19 (describing deinterleaver for 64 sub-channel RU).
10[H]. wherein the first size is smaller than a size of the transmission channel, the second size is smaller than the first size, and the second set of interleaving parameter values is different from the first set of interleaving parameter values.	*See* disclosures cited above for 1[G]. As shown above, the first size (128 sub-carriers, 10MHz) is smaller than the transmission channel (256 sub-carriers, 20MHz). The second size (64 sub-carriers, 5MHz) is smaller than the first size (128 sub-carriers, 10MHz). The second set of interleaving parameter values is different from the first set of interleaving parameter values.

Claim 11	**'187 Provisional App**
11. The method according to claim 10, wherein the size of the resource unit corresponds to a number of tones allocated to the resource unit allocated to the first STA.	*See* disclosures cited above for [2], [10].

Claim 12	**'187 Provisional App**
12[A]. The method according to claim 10, wherein the set of sizes available to the resource unit allocated to the first STA further includes a third size,	*See* disclosures cited above for 4[A], [10].

[redacted]

[12B] wherein the deinterleaving of the data unit for the first STA further comprises, when the size of the resource unit allocated to the first STA is the third size, deinterleaving the data unit for the first STA using a third set of interleaving parameter values, and	*See* disclosures cited above for 4[B], 4[C], [10].
[12C] wherein the third size is smaller than the second size, and the third set of interleaving parameter values is different from the second set of interleaving parameter values.	*See* disclosures cited above for 4[D], [10].

Claim 13	**'187 Provisional App**
13. The method according to claim 10, wherein the size of the transmission channel is 20 MHz.	*See* disclosures cited above for [10]. "In a HEW PPDU, a PSDU may be transmitted independently on a sub-channel basis. The channel bandwidth of each sub-channel may be 2.5MHz, 5MHz, 10MHz, 20MHz, 40MHz, or 80MHz. For example, PSDUs are transmitted simultaneously to four STAs using 256 FFT on a 20-MHz channel. In this case, the channel bandwidths of PSDUs directed to 4 STAs may be different, 2.5MHz, 2.5MHz, 5MHz, and 10MHz. The channel bandwidth of a PSDU transmitted on each sub-channel may be different in a HEW PPDU. To support this, an interleaver used for PSDU transmission on a sub-channel basis may operate independently using different interleaver depths (N_{COL}) and N_{ROW} values." *Id.* at 20.

Claim 14	**'187 Provisional App**
14[A]. A method for receiving data from an Access Point (AP) through a transmission channel by a first Station (STA) among a plurality of STAs in a Wireless Local Area Network (WLAN) system, wherein the transmission channel is divided into a plurality of OFDMA resource units which are allocated to the plurality of STAs respectively, the method comprising:	*See* disclosures cited above for 10[A].
[14B] receiving, through the transmission channel, a Physical layer	*See* disclosures cited above for 10[B].

[redacted]

Protocol Data Unit (PPDU) frame including a plurality of data units for the plurality of STAs respectively on the plurality of OFDMA resource units to acquire a data unit for the first STA from an OFDMA resource unit allocated to the first STA; and	
[14C] deinterleaving the data unit for the first STA based on a size of the OFDMA resource unit allocated to the first STA,	*See* disclosures cited above for 10[C].
[14D] wherein a set of sizes available to the OFDMA resource unit allocated to the first STA includes a first size and a second size,	*See* disclosures cited above for 10[D].
[14E] wherein deinterleaving of the data for the first STA comprises:	*See* disclosures cited above for 10[E].
[14F] when the size of the OFDMA resource unit allocated to the first STA is the first size, deinterleaving the data unit for the first STA using a first set of interleaving parameter values; and	*See* disclosures cited above for 10[F].
[14G] when the size of the OFDMA resource unit allocated to the first STA is the second size, deinterleaving the data unit for the first STA using a second set of interleaving parameter values, and	*See* disclosures cited above for 10[G].
[14H] wherein the first size is smaller than a size of the transmission channel, the second size is smaller than the first size, and the second set of interleaving parameter values is different from the first set of interleaving parameter values.	*See* disclosures cited above for 10[H].

9.3 Prosecution History

346. On August 11, 2015, the Applicant filed the '187 application with 21 initial claims. ATLAS-00004301-4367.

347. On April 8, 2016, the examiner issued a non-final rejection. He rejected claim 12 under 35 USC §101, and rejected claims 1-5, 14-17, 20, and 21 under 35 USC §103 in view

[redacted]

of "Yang" (US Pat. Pub. No. 2013/0177090) and "Kang" (US Pat. Pub. No. 2012/0230448). ATLAS-00004430-8.

348. In response to the rejection, the applicant submitted claim amendments on June 12, 2016. The applicant argued that the amendments overcame all examiner rejections. ATLAS-00004447-56.

349. The examiner issued a notice of allowance on August 25, 2016. ATLAS-00004460-64.

350. The '187 Patent issued on December 27, 2016.

9.4 Overview of Alleged '187 Prior Art

351. Dr. Hansen analyzes five references in connection with the '187 Patent: (1) U.S. Patent Pub. No. 2017/0272295 ("Lee," Hansen Ex. 187-2), (2) U.S. Patent Pub. No. 2017/0339701 ("Choi," Hansen Ex. 187-3), (3) U.S. Patent Pub. No. 2012/0051447 ("Qi," Hansen Ex. 187-4), (4) "Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications Amendment 4: Enhancements for Very High Throughput for Operation in Bands below 6 GHz" ("802.11ac-2013," Hansen Ex. 187-5), and (5) "Interleaver and Tone Mapper for OFDMA" ("Marvell," Hansen Ex. 187-6). Hansen Report at ¶879. I provide an overview of each below.

9.4.1 Lee

352. Lee is titled "Transmitting and Receiving Device and Method in Wireless Communication System." Lee characterizes itself as disclosing "a method fix a station (STA) device transmitting data in a Wireless Local Area Network (WLAN) system. The method for transmitting data, according to one embodiment of the present invention, comprises the steps of: FEC encoding transmission data; interleaving the transmission data; constellation mapping the transmission data; performing IDFT on the transmission data; and upconverting the transmission data and transmitting a transmission signal, wherein IDFT is performed using different FFT sizes for a first part of the transmission signal and a second part of the transmission signal, and the second part of the transmission signal is

[redacted]

allocated to at least one STA in units of at least one resource unit." *Id.* at Abstract. As I explain in more detail below, Lee is not prior art and lacks many key elements of the '187 claims.

9.4.2 Choi

353. Choi is titled "Method and Device of Allocating Resource Unit on Basis of Container in Wireless LAN." Choi characterizes itself as disclosing "a method and a device for allocating a resource unit on the basis of a container in a wireless LAN. The method for allocating a resource unit in a wireless LAN comprises the steps of: generating, by an AP, a PPDU to be transmitted to a plurality of STAs; and transmitting, by the AP, the PPDU to the plurality of STAs through at least one container allocated on the entire frequency band, wherein the PPDU includes MU/SU transmission indication information and resource allocation information for each container, the MU/SU transmission indication information includes information on whether an SU-based transmission or an MU-based transmission is carried out on the entire bandwidth, and the resource allocation information for each container can include information on the number of STAs allocated to each of the at least one container." *Id.* at Abstract. As I explain in more detail below, Choi is not prior art and lacks many key elements of the '187 claims.

9.4.3 Qi

354. Qi is titled "Optimum Interleaver Design for a Communication System." Qi characterizes itself as disclosing "method for interleaving information bits in a physical layer (PHY) data unit. a channel bandwidth to be used for transmitting the PHY data unit is determined and a frequency rotation parameter N_{ROT} corresponding to the channel bandwidth is selected. A spatial stream constant is selected for each spatial stream from the set [0, 5, 2, 7, 3, 6, 1, 4] or a subset thereof depending on a number of spatial streams to be utilized, wherein each constant in the set corresponds to a respective spatial stream. Information bits are interleaved according to the selected frequency rotation parameter

[redacted]

N_{ROT} and the selected spatial stream constant." *Id.* at Abstract. As I explain in more detail below, Qi lacks many key elements of the '187 claims.

9.4.4 802.11ac-2013

355. 802.11ac-2013 is titled "Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications; Amendment 4: Enhancements for Very High Throughput for Operation in Bands below 6 GHz." 802.11ac-2013 is colloquially referred to as "Wi-Fi 5." 802.11ac-2013 supported limited DL MU operations (*i.e.*, DL MU MIMO). However, 802.11ac lacked many key features of Wi-Fi 6, such as the concept of "resource units" and the concept of interleaving based on the size of resource units.

9.4.5 Marvell

356. Marvell is titled "Interleaver and Tone Mapper for OFDMA." Marvell is a TGAX submission that is primarily concerned with presenting the results of simulations demonstrating the effects of different numbers of frequency rotations on packet error rate. As I explain in more detail below, Marvell is not prior art and lacks many key elements of the '187 claims.

9.5 Asserted Claims

357. The '187 Asserted Claims are reproduced below.

Claim 1
1[A]. A method for transmitting data to a plurality of Stations (STAs) through a transmission channel by an Access Point (AP) in a Wireless Local Area Network (WLAN) system, wherein the transmission channel is divided into a plurality of resource units which are allocated to the plurality of STAs respectively, the method comprising:
1[B]. interleaving a plurality of data units for the plurality of STAs based on sizes of the plurality of resource units allocated to the plurality of STAs to generate a plurality of interleaved data units; and
1[C]. transmitting, through the transmission channel, a Physical layer Protocol Data Unit (PPDU) frame including the plurality of interleaved data units respectively on the plurality of resource units to the plurality of STAs,
1[D]. wherein a set of sizes available to a resource unit allocated to a first STA among the plurality of STAs includes a first size and a second size,
1[E]. wherein the interleaving of the plurality of data units for the plurality of STAs comprises:
1[F]. when the size of the resource unit allocated to the first STA is the first size, interleaving a data unit for the first STA using a first set of interleaving parameter values; and

[redacted]

1[G]. when the size of the resource unit allocated to the first STA is the second size, interleaving the data unit for the first STA using a second set of interleaving parameter values, and
1[H]. wherein the first size is smaller than a size of the transmission channel, the second size is smaller than the first size, and the second set of interleaving parameter values is different from the first set of interleaving parameter value.

Claim 2
2. The method according to claim 1, wherein a size of each of the plurality of resource units corresponds to a number of tones allocated to said each of the plurality of resource units.

Claim 3
3. The method according to claim 2, wherein the number of tones allocated to said each of the plurality of resource units includes a number of tones used for complex data and a number of tones used for pilot in said each of the plurality of resource units.

Claim 4
4[A]. The method according to claim 1, wherein the set of sizes available to the resource unit allocated to the first STA among the plurality of STAs further includes a third size,
[4B]. wherein the interleaving of the plurality of data units for the plurality of STAs further comprises:
[4C]. when the size of the resource unit allocated to the first STA is the third size, interleaving the data unit for the first STA using a third set of interleaving parameter values, and
[4D]. wherein the third size is smaller than the second size, and the third set of interleaving parameter values is different from the second set of interleaving parameter values.

Claim 5
5. The method according to claim 1, wherein an interleaver depth for the first set of interleaving parameter values is different from an interleaver depth for the second set of interleaving parameter values.

Claim 6
6. The method according to claim 1, wherein each of the first set of interleaving parameter values and the second set of interleaving parameter values includes the number NCOL of columns in a block interleaver, the number NROW of rows in the block interleaver, and a frequency rotation parameter NROT.

Claim 7
7. The method according to claim 1, wherein the interleaving of the plurality of data units for the plurality of STAs comprises: when the size of the resource unit allocated to the first STA is 24 data tones, interleaving the data unit for the first STA using a block interleaver having 8 columns.

Claim 8

[redacted]

8[A]. The method according to claim 1, wherein:

[8B] when an index of a bit input for interleaving is k, an index i and an index j are calculated by the following equations,

$$i = N_{ROW}(k \bmod N_{COL}) + \left\lfloor \frac{k}{N_{COL}} \right\rfloor, k = 0, 1, \ldots, N_{CBPSSI} - 1$$

$$j = s\left\lfloor \frac{i}{s} \right\rfloor + \left(i + N_{CBPSSI} - \left\lfloor \frac{N_{COL} \cdot i}{N_{CBPSSI}} \right\rfloor\right) \bmod s,$$

$$i = 0, 1, \ldots, N_{CBPSSI} - 1$$

$$s = \max\left\{1, \frac{N_{BPSCS}}{2}\right\}$$

i is an index obtained by applying a first permutation to the index k, j is an index obtained by applying a second permutation to the index i,

[8C] when a number of spatial streams NSS=is 1, an index r obtained by frequency rotation is calculated by r=j, and

[8D] when 2≦NSS≦4, the index r is calculated by

$$r = \left\{j - \left[(2(i_{SS} - 1)) \bmod 3 + 3\left\lfloor \frac{i_{SS} - 1}{3} \right\rfloor\right] \cdot N_{ROT} \cdot N_{BPSCS}\right\} \bmod N_{CBPSSI},$$

$$j = 0, 1, \ldots, N_{CBPSSI} - 1$$

$$i_{SS} = 1, 2, \ldots, N_{SS}$$

where: mod represents a modulo operation, $\lfloor\ \rfloor$ is a floor operation, NCOL is a number of columns in a block interleaver, NROW is a number of rows in the block interleaver, NROT is a frequency rotation parameter, and NCBPSSI is the number of coded bits per symbol per spatial stream per interleaver block.

Claim 9
9. The method according to claim 8, wherein NSS is set to separate values for the plurality of resource units.

Claim 10
10[A]. A method for receiving data from an Access Point (AP) through a transmission channel by a first Station (STA) among a plurality of STAs in a Wireless Local Area Network (WLAN) system, wherein the transmission channel is divided into a plurality of resource units which are allocated to the plurality of STAs respectively, the method comprising:
[10B] receiving, through the transmission channel, a Physical layer Protocol Data Unit (PPDU) frame including a plurality of data units for the plurality of STAs respectively on the plurality of resource units to acquire a data unit for the first STA from a resource units allocated to the first STA; and
[10C] deinterleaving the data unit for the first STA based on a size corresponding to the resource unit allocated to the first STA,
[10D] wherein a set of sizes available to the resource unit allocated to the first STA includes a first size and a second size,
[10E] wherein the deinterleaving of the data unit for the STA comprises:

[redacted]

10[F]. when the size of resource unit allocated to the first STA is the first size, deinterleaving the data unit for the first STA using a first set of interleaving parameter values; and
10[G]. when the size of resource unit allocated to the first STA is the second size, deinterleaving the data unit for the first STA using a second set of interleaving parameter values; and
10[H]. wherein the first size is smaller than a size of the transmission channel, the second size is smaller than the first size, and the second set of interleaving parameter values is different from the first set of interleaving parameter values.

Claim 11
11. The method according to claim 10, wherein the size of the resource unit corresponds to a number of tones allocated to the resource unit allocated to the first STA.

Claim 12
12[A]. The method according to claim 10, wherein the set of sizes available to the resource unit allocated to the first STA further includes a third size,
[12B] wherein the deinterleaving of the data unit for the first STA further comprises, when the size of the resource unit allocated to the first STA is the third size, deinterleaving the data unit for the first STA using a third set of interleaving parameter values, and
[12C] wherein the third size is smaller than the second size, and the third set of interleaving parameter values is different from the second set of interleaving parameter values.

Claim 13
13. The method according to claim 10, wherein the size of the transmission channel is 20 MHz.

Claim 14
14[A]. A method for receiving data from an Access Point (AP) through a transmission channel by a first Station (STA) among a plurality of STAs in a Wireless Local Area Network (WLAN) system, wherein the transmission channel is divided into a plurality of OFDMA resource units which are allocated to the plurality of STAs respectively, the method comprising:
[14B] receiving, through the transmission channel, a Physical layer Protocol Data Unit (PPDU) frame including a plurality of data units for the plurality of STAs respectively on the plurality of OFDMA resource units to acquire a data unit for the first STA from an OFDMA resource unit allocated to the first STA; and
[14C] deinterleaving the data unit for the first STA based on a size of the OFDMA resource unit allocated to the first STA,
[14D] wherein a set of sizes available to the OFDMA resource unit allocated to the first STA includes a first size and a second size,
[14E] wherein deinterleaving of the data for the first STA comprises:
[14F] when the size of the OFDMA resource unit allocated to the first STA is the first size, deinterleaving the data unit for the first STA using a first set of interleaving parameter values; and

[redacted]

[14G] when the size of the OFDMA resource unit allocated to the first STA is the second size, deinterleaving the data unit for the first STA using a second set of interleaving parameter values, and
[14H] wherein the first size is smaller than a size of the transmission channel, the second size is smaller than the first size, and the second set of interleaving parameter values is different from the first set of interleaving parameter values.

9.6 Claim Construction

358. The Court issued a claim construction order on February 8, 2023 ("Claim Construction Order" or "Markman Order"). Dkt. No. 117. I have applied the constructions therein. For terms the court did not construe, I have applied the plain and ordinary meaning to a person of ordinary skill in the art at the time of invention.

359. With respect to the '187 Patent, the Court did not construe any terms.

9.7 Dr. Hansen's Alleged Prior Art Does Not Invalidate the Asserted '187 Claims

360. Dr. Hansen states that each of the following references anticipate the Asserted '187 claims: Lee, Choi, Qi, 802.11ac-2013, and Marvell. Hansen Report at ¶879. Dr. Hansen also states that those same references render the Asserted '187 claims obvious, either by themselves or in any combination of those five references. *Id.* I disagree.

9.7.1 Lee Fails To Disclose Or Render Obvious Several '187 Claim Limitations

9.7.1.1 Lee is Not Prior Art

361. Dr. Hansen does not state in his report why he believes Lee is prior art to the '187 Patent, and does not attempt to show any evidence that Lee is prior art. He does not say what statutory language he believes Lee qualifies as prior art under.

362. Lee states that it was filed July 2, 2015 as PCT Application No. PCT/KR2015/006834 and was published September 21, 2017 as US 2017/0272295.

363. Lee is not prior art to the '187 Patent because the Lee application was filed after the priority date of the '187 patent, which was August 11, 2014 based on the Korean Provisional Application No. 10-2014-0103275.

[redacted]

364. Even if the '187 Patent was only entitled to its US Provisional priority date (No. 62/135,094) filed March 18, 2015, Lee would still not be prior art because Lee was filed after this date.

365. Lee indicates it has three related provisional applications (Nos. 62/030,018, 62/034,732 and 62/034,764) but Dr. Hansen does not indicate or establish that Lee was disclosed or is enabled by those provisional applications. As such, Dr. Hansen has not shown that Lee is prior art.

9.7.1.2 Claim 7: The method according to claim 1, wherein the interleaving of the plurality of data units for the plurality of STAs comprises: when the size of the resource unit allocated to the first STA is 24 data tones, interleaving the data unit for the first STA using a block interleaver having 8 columns.

366. Dr. Hansen states that Lee teaches Claim 7. Hansen Report at ¶¶1095-98. I disagree.

367. Dr. Hansen cites Lee at ¶¶ [0276], [0333], [0336]-[0338]. None of the cited text discloses "24 data tones" or "a block interleaver having 8 columns." It is unclear why Dr. Hansen believes these elements are disclosed by the cited text, and he does not provide any explanation.

368. For these reasons, it is my opinion that Dr. Hansen has not shown Lee teaches or suggests Claim 7.

9.7.1.3 [8B] when an index of a bit input for interleaving is k, an index i and an index j are calculated by the following equations [...], i is an index obtained by applying a first permutation to the index k, j is an index obtained by applying a second permutation to the index i,

369. Claim 8 of the '187 Patent requires Element 8[B]. The equations required by Element 8[B] are:

[redacted]

$$i = N_{ROW}(k \bmod N_{COL}) + \left\lfloor \frac{k}{N_{COL}} \right\rfloor, k = 0, 1, \ldots , N_{CBPSSI} - 1$$

$$j = s\left\lfloor \frac{i}{s} \right\rfloor + \left(i + N_{CBPSSI} - \left\lfloor \frac{N_{COL} \cdot i}{N_{CBPSSI}} \right\rfloor\right) \bmod s,$$

$$i = 0, 1, \ldots , N_{CBPSSI} - 1$$

$$s = \max\left\{1, \frac{N_{BPSCS}}{2}\right\}$$

370. Dr. Hansen states that Lee teaches Element 8[B]. Hansen Report at ¶1112-15. I disagree.

371. The equations Dr. Hansen cites as allegedly disclosing this limitation are:

$$i = N_{ROW}(k \bmod N_{COL}) + \left\lfloor \frac{k}{N_{COL}} \right\rfloor \quad \text{[Equation 1]}$$

$$j = s\left\lfloor \frac{i}{s} \right\rfloor + \left(i + N_{CBPSSI} - \left\lfloor \frac{N_{COL} \cdot i}{N_{CBPSSI}} \right\rfloor\right) \quad \text{[Equation 2]}$$

372. In the second equation required by this claim element, the second term is multiplied by "mod*s*" but in Equation 2 of Lee the "mod*s*" term is not present.

373. Moreover, the passages of Lee cited by Dr. Hansen do not disclose the third permutation (i.e., $s = \max\{1, N_{BPSCS}/2\}$), which is also a requirement of Element 8[B],.

374. For these reasons, it is my opinion that Dr. Hansen has not shown Lee teaches or suggests Element 8[B].

9.7.1.4 Claim 9: The method according to claim 8, wherein NSS is set to separate values for the plurality of resource units.

375. Dr. Hansen states that Lee teaches Claim 9. Hansen Report at ¶1131-33. I disagree.

376. Dr. Hansen cites Lee at ¶ [0276] and Table 1. The cited passage says "N_SS indicates the number of special [sic] streams." But this passage does not disclose that NSS

[redacted]

can have different values for different resource units in the DL MU frame as required by Claim 9.

377. For these reasons, it is my opinion that Dr. Hansen has not shown Lee teaches or suggests Claim 9.

9.7.2 Choi Fails To Disclose Or Render Obvious Several '187 Claim Limitations

9.7.2.1 Choi is Not Prior Art

378. Dr. Hansen does not state in his report why he believes Choi is prior art to the '187 Patent, and does not attempt to show any evidence that Choi is prior art. He does not say what statutory language he believes Choi qualifies as prior art under.

379. Choi states that it was filed November 5, 2015 as PCT Application No. PCT/KR2015/011855 and was published November 23, 2017 as US 2017/0339701.

380. Choi is not prior art to the '187 Patent because the Choi application was filed after the priority date of the '187 patent, which was August 11, 2014 based on the Korean Provisional Application No. 10-2014-0103275.

381. Even if the '187 Patent was only entitled to its US Provisional priority date (No. 62/135,094) filed March 18, 2015, Choi would still not be prior art because Choi was filed after this date.

382. Even if the '187 Patent was only entitled to its non-provisional filing date of August 11, 2015, Choi would still not be prior art because Choi was filed after this date.

383. Choi indicates it has two related provisional applications (Nos. 62/075,272 and 62/088,688) but Dr. Hansen does not indicate or establish that Choi was disclosed or is enabled by those provisional applications. As such, Dr. Hansen has not shown that Choi is prior art.

[redacted]

9.7.2.2 Element 1 [d]: wherein the interleaving of the plurality of data units for the plurality of STAs comprises: when the size of the resource unit allocated to the first STA is the first size, interleaving a data unit for the first STA using a first set of interleaving parameter values; and

384. Claim 1 of the ’187 Patent requires Element 1[d].

385. Dr. Hansen states that Choi teaches Element 1[d]. Hansen Report at ¶¶946-38. I disagree.

386. Dr. Hansen cites Choi at ¶¶ [0061], [0102], and [0145]. Dr. Hansen does not say what statements in these passages allegedly constitute “the first size” and he does not explain what he alleges discloses “interleaving a data unit for the first STA using a first set of interleaving parameter values.”

387. Choi at ¶ [0145] states: “an interleaver for the 242-tone resource units and an interleaver for the 26-tone resource units may be individually applied to each of the 242-tone resource units and the 26-tone resource units.” This passage does not disclose any “interleaving parameter values” associated with the interleaver.

388. The ’187 Patent gives examples of interleaving parameter values at, *e.g.*, 22:54-23:3. None of the passages cited by Dr. Hansen mention any of these parameter values neither is there any analysis about any interleaving parameter values.

389. For these reasons, it is my opinion that Dr. Hansen has not shown Choi teaches or suggests Element 1[d].

9.7.2.3 Element 1 [e]: when the size of the resource unit allocated to the first STA is the second size, interleaving the data unit for the first STA using a second set of interleaving parameter values, and

390. Dr. Hansen states that Choi teaches Element 1[e]. Hansen Report at ¶¶961-62. I disagree.

391. Dr. Hansen cites Choi at ¶ [0145]. He does not explain what in this paragraph is “the second size” and he does not explain what he alleges discloses “interleaving a data unit for the first STA using a second set of interleaving parameter values.”

[redacted]

392. As I explain above regarding Element 1[d], ¶ [0145] of Choi does not disclose any interleaving parameter values.

393. For these reasons, it is my opinion that Dr. Hansen has not shown Choi teaches or suggests Element 1[e].

9.7.2.4 Element 1 [f]: wherein the first size is smaller than a size of the transmission channel, the second size is smaller than the first size, and the second set of interleaving parameter values is different from the first set of interleaving parameter value.

394. Dr. Hansen states that Choi teaches Element 1[f]. Hansen Report at ¶¶974-75. I disagree.

395. Dr. Hansen cites Choi at ¶ [0145]. As I explain above regarding Elements 1[d] and 1[e], he does not explain what in this paragraph is "the first size" or "the second size" and he does not explain what he alleges discloses "the first set of interleaving parameter values" or "the second set of interleaving parameter values." He also does not explain how the first and second interleaving parameter values are different.

396. As I explain above regarding Element 1[d], ¶ [0145] of Choi does not disclose any interleaving parameter values.

397. For these reasons, it is my opinion that Dr. Hansen has not shown Choi teaches or suggests Element 1[f].

9.7.2.5 Claim 3: The method according to claim 2, wherein the number of tones allocated to said each of the plurality of resource units includes a number of tones used for complex data and a number of tones used for pilot in said each of the plurality of resource units.

398. Dr. Hansen states that Choi teaches Claim 3. Hansen Report at ¶¶1003-06. I disagree.

399. Dr. Hansen cites Choi at ¶¶ [0045], [0222]-[0226], [0300]. None of the cited passages mention "a number of tones used for complex data" or "a number of tones used for pilot." It is unclear why Dr. Hansen believes these elements are disclosed by the cited text, and he does not provide any explanation.

[redacted]

400. For these reasons, it is my opinion that Dr. Hansen has not shown Choi teaches or suggests Claim 3.

9.7.2.6 Element 4 [a]: The method according to claim 1, wherein the set of sizes available to the resource unit allocated to the first STA among the plurality of STAs further includes a third size,

401. Dr. Hansen states that Choi teaches Element 4[a]. Hansen Report at ¶¶1021-22. I disagree.

402. Dr. Hansen cites Choi at ¶ [0140]. This text does not disclose any "third size" of a resource unit. Rather, in the cited text, all of the resource units are the same size, namely 242-tones. It is unclear why Dr. Hansen believes a "third size" is disclosed by the cited text, and he does not provide any explanation.

403. For these reasons, it is my opinion that Dr. Hansen has not shown Choi teaches or suggests Element 4[a].

9.7.2.7 Element 4 [b]: wherein the interleaving of the plurality of data units for the plurality of STAs further comprises: when the size of the resource unit allocated to the first STA is the third size, interleaving the data unit for the first STA using a third set of interleaving parameter values, and

404. Dr. Hansen states that Choi teaches Element 4[b]. Hansen Report at ¶¶1035-36. I disagree.

405. Dr. Hansen cites Choi at ¶ [0140]. As I explained above regarding Element 4[a], this paragraph of Choi does not disclose any "third size."

406. Additionally, this paragraph of Choi does not disclose "interleaving the data unit for the first STA using a third set of interleaving parameter values." In fact, this paragraph does not mention interleaving at all. It is unclear why Dr. Hansen believes "interleaving the data unit for the first STA using a third set of interleaving parameter values" is disclosed by the cited text, and he does not provide any explanation.

407. For these reasons, it is my opinion that Dr. Hansen has not shown Choi teaches or suggests Element 4[b].

[redacted]

9.7.2.8 Element 4 [c]: wherein the third size is smaller than the second size, and the third set of interleaving parameter values is different from the second set of interleaving parameter values.

408. Dr. Hansen states that Choi teaches Element 4[c]. Hansen Report at ¶¶1048-49. I disagree.

409. Dr. Hansen cites Choi at ¶ [0140]. As I explained above regarding Element 4[a] and 4[b], this paragraph of Choi does not disclose any "third size" or "third set of interleaving parameter values."

410. Also, as I discussed above at Elements 1[d], 1[e], and 1[f], Dr. Hansen has not shown that Choi discloses "the first size" or "the second size" and he has not shown that Choi discloses "the first set of interleaving parameter values" or "the second set of interleaving parameter values."

411. Dr. Hansen also does not explain how the third and second interleaving parameter values are different.

412. For these reasons, it is my opinion that Dr. Hansen has not shown Choi teaches or suggests Element 4[c].

9.7.2.9 Claim 6: The method according to claim 1, wherein each of the first set of interleaving parameter values and the second set of interleaving parameter values includes the number NCOL of columns in a block interleaver, the number NROW of rows in the block interleaver, and a frequency rotation parameter NROT.

413. Dr. Hansen states that Choi teaches Claim 6. Hansen Report at ¶¶1079-81. I disagree.

414. Dr. Hansen cites Choi at ¶ [0056]. This paragraph does not mention any interleaver or any interleaving parameter values. It does not make any reference to the number of columns in a block interleaver, the number of rows in the block interleaver, or a frequency rotation parameter. It is unclear why Dr. Hansen believes these elements are disclosed by the cited text, and he does not provide any explanation.

[redacted]

415. For these reasons, it is my opinion that Dr. Hansen has not shown Choi teaches or suggests Claim 6.

9.7.2.10 Element 10 [d]: wherein the deinterleaving of the data unit for the STA comprises: when the size of resource unit allocated to the first STA is the first size, deinterleaving the data unit for the first STA using a first set of interleaving parameter values; and

416. Dr. Hansen states that Choi teaches Element 10[d]. Hansen Report at ¶¶1242-44. I disagree.

417. Dr. Hansen cites Choi at ¶¶ [0222]-[0226]. None of these paragraphs mention interleaving or deinterleaving, and they do not mention any "first set of interleaving parameter values." It is unclear why Dr. Hansen believes this element is disclosed by the cited text, and he does not provide any explanation.

418. I further incorporate here my opinions about why Dr. Hansen has not shown Choi discloses Element 1[d].

419. For these reasons, it is my opinion that Dr. Hansen has not shown Choi teaches or suggests Element 10[d].

9.7.2.11 Element 10 [e]: when the size of resource unit allocated to the first STA is the second size, deinterleaving the data unit for the first STA using a second set of interleaving parameter values; and values, and

420. Dr. Hansen states that Choi teaches Element 10[e]. Hansen Report at ¶¶1263-65. I disagree.

421. Dr. Hansen cites Choi at ¶ [0145]. This is the same paragraph Dr. Hansen cited regarding Element 1[e]. As I explained above, Dr. Hansen does not explain what in this paragraph is "the second size" and he does not explain what he alleges discloses "deinterleaving a data unit for the first STA using a second set of interleaving parameter values."

422. I further incorporate here my opinions about why Dr. Hansen has not shown Choi discloses Element 1[e].

[redacted]

423. For these reasons, it is my opinion that Dr. Hansen has not shown Choi teaches or suggests Element 10[e].

9.7.2.12 Element 10 [f]: wherein the first size is smaller than a size of the transmission channel, the second size is smaller than the first size, and the second set of interleaving parameter values is different from the first set of interleaving parameter values.

424. Dr. Hansen states that Choi teaches Element 10[f]. Hansen Report at ¶¶1284-86. I disagree.

425. Dr. Hansen cites Choi at ¶ [0145]. This is the same paragraph Dr. Hansen cited regarding Element 1[f]. As I explained above, Dr. Hansen does not explain what in this paragraph is "the first size" or "the second size" and he does not explain what he alleges discloses "the first set of interleaving parameter values" or "the second set of interleaving parameter values." He also does not explain how the first and second interleaving parameter values are different.

426. I further incorporate here my opinions about why Dr. Hansen has not shown Choi discloses Element 1[f].

427. For these reasons, it is my opinion that Dr. Hansen has not shown Choi teaches or suggests Element 10[f].

9.7.2.13 Element 12 [a]: The method according to claim 10, wherein the set of sizes available to the resource unit allocated to the first STA further includes a third size,

428. Dr. Hansen states that Choi teaches Element 12[a]. Hansen Report at ¶¶1327-29. I disagree.

429. Dr. Hansen cites Choi at ¶ [0140]. This is the same paragraph Dr. Hansen cited regarding Element 4[a]. As I explained above, this text does not disclose any "third size" of a resource unit. Rather, in the cited text, all of the resource units are the same size, namely 242-tones. It is unclear why Dr. Hansen believes a "third size" is disclosed by the cited text, and he does not provide any explanation.

[redacted]

430. I further incorporate here my opinions about why Dr. Hansen has not shown Choi discloses Element 4[a].

431. For these reasons, it is my opinion that Dr. Hansen has not shown Choi teaches or suggests Element 12[a].

9.7.2.14 Element 12 [b]: wherein the deinterleaving of the data unit for the first STA further comprises, when the size of the resource unit allocated to the first STA is the third size, deinterleaving the data unit for the first STA using a third set of interleaving parameter values, and

432. Dr. Hansen states that Choi teaches Element 12[b]. Hansen Report at ¶¶1345-47. I disagree.

433. Dr. Hansen cites Choi at ¶ [0140]. This is the same paragraph Dr. Hansen cited regarding Element 4[b]. As I explained above, this paragraph of Choi does not disclose "deinterleaving the data unit for the first STA using a third set of interleaving parameter values." In fact, this paragraph does not mention interleaving or deinterleaving at all. It is unclear why Dr. Hansen believes "deinterleaving the data unit for the first STA using a third set of interleaving parameter values" is disclosed by the cited text, and he does not provide any explanation.

434. I further incorporate here my opinions about why Dr. Hansen has not shown Choi discloses Element 4[b].

435. For these reasons, it is my opinion that Dr. Hansen has not shown Choi teaches or suggests Element 12[b].

9.7.2.15 Element 12 [c]: wherein the third size is smaller than the second size, and the third set of interleaving parameter values is different from the second set of interleaving parameter values.

436. Dr. Hansen states that Choi teaches Element 12[c]. Hansen Report at ¶¶1364-66. I disagree.

[redacted]

437. Dr. Hansen cites Choi at ¶ [0140]. This is the same paragraph Dr. Hansen cited regarding Element 4[c]. As I explained above, this paragraph of Choi does not disclose any "third size" or "third set of interleaving parameter values."

438. I further incorporate here my opinions about why Dr. Hansen has not shown Choi discloses Element 4[c].

439. For these reasons, it is my opinion that Dr. Hansen has not shown Choi teaches or suggests Element 12[c].

9.7.2.16 Element 14 [d]: wherein deinterleaving of the data for the first STA comprises: when the size of the OFDMA resource unit allocated to the first STA is the first size, deinterleaving the data unit for the first STA using a first set of interleaving parameter values; and

440. Dr. Hansen states that Choi teaches Element 14[d]. Hansen Report at ¶¶1490-93. I disagree.

441. Dr. Hansen cites Choi at ¶¶ [0045], [0145]. Dr. Hansen cited ¶[0145] regarding Elements 1[d] and 10[d]. Dr. Hansen does not say what statements in these passages allegedly constitute "the first size" and he does not explain what he alleges discloses "deinterleaving a data unit for the first STA using a first set of interleaving parameter values."

442. I further incorporate here my opinions about why Dr. Hansen has not shown Choi discloses Elements 1[d] and 10[d].

443. For these reasons, it is my opinion that Dr. Hansen has not shown Choi teaches or suggests Element 14[d].

9.7.2.17 Element 14 [e]: when the size of the OFDMA resource unit allocated to the first STA is the second size, deinterleaving the data unit for the first STA using a second set of interleaving parameter values, and

444. Dr. Hansen states that Choi teaches Element 14[e]. Hansen Report at ¶¶1512-15. I disagree.

[redacted]

445. Dr. Hansen cites Choi at ¶¶ [0045], [0145]. Dr. Hansen cited ¶[0145] regarding Elements 1[e] and 10[e]. Dr. Hansen has not shown what in these paragraphs is "the second size" and he does not explain what he alleges discloses "deinterleaving a data unit for the first STA using a second set of interleaving parameter values."

446. I further incorporate here my opinions about why Dr. Hansen has not shown Choi discloses Elements 1[e] and 10[e].

447. For these reasons, it is my opinion that Dr. Hansen has not shown Choi teaches or suggests Element 14[e].

9.7.2.18 Element 14 [f]: wherein the first size is smaller than a size of the transmission channel, the second size is smaller than the first size, and the second set of interleaving parameter values is different from the first set of interleaving parameter values.

448. Dr. Hansen states that Choi teaches Element 14[f]. Hansen Report at ¶¶1534-36. I disagree.

449. Dr. Hansen cites Choi at ¶ [0145]. Dr. Hansen cited ¶[0145] regarding Elements 1[f] and 10[f]. , Dr. Hansen does not explain what in this paragraph is "the first size" or "the second size" and he does not explain what he alleges discloses "the first set of interleaving parameter values" or "the second set of interleaving parameter values." He also does not explain how the first and second interleaving parameter values are different.

450. I further incorporate here my opinions about why Dr. Hansen has not shown Choi discloses Elements 1[f] and 10[f].

451. For these reasons, it is my opinion that Dr. Hansen has not shown Choi teaches or suggests Element 14[f].

[redacted]

9.7.3 Qi Fails To Disclose Or Render Obvious Several '187 Claim Limitations

9.7.3.1 Element 1 [pre]: A method for transmitting data to a plurality of Stations (STAs) through a transmission channel by an Access Point (AP) in a Wireless Local Area Network (WLAN) system, wherein the transmission channel is divided into a plurality of resource units which are allocated to the plurality of STAs respectively, the method comprising

452. Dr. Hansen states that Qi teaches Elements 1[pre]. Hansen Report at ¶¶887-89. I disagree.

453. Dr. Hansen cites Qi at ¶¶ [0015], [0016], [0019].

454. Element 1[pre] requires "a plurality of resource units which are allocated to the plurality of STAs respectively." Dr. Hansen does not explain what in these passages he believes discloses "a plurality of resource units which are allocated to the plurality of STAs respectively."

455. Qi at ¶ [0019] states "[i]n various embodiments, the PHY processing unit 20 of the AP 14 is configured to generate data units conforming to the first communication protocol. The transceiver(s) 21 is/are configured to transmit the generated data units via the antenna(s) 24."

456. It may be that Dr. Hansen believes the "data units" in the above passage are resource units. But Dr. Hansen does not explain why he believes the "data units" are resource units. In the cited passage, the "data units" appear to simply refer to units of data generated by the PHY processing unit for transmission. There is no indication that this reference to "data units" has anything to do with resource units.

457. Moreover, as I discuss below at Element 1[a], Dr. Hansen seems to change his theory of what constitutes a "resource unit" and no longer points to "data units" in the context of Element 1[a]. This internal inconsistency shows that Dr. Hansen has failed to identify the claimed "resource units" anywhere in Qi.

458. Moreover, there is no disclosure in the above passages of any resource units being "allocated to the plurality of STAs respectively." None of the cited passages refer to multi-

[redacted]

user transmissions. Terms such as "multi-user," "MU-MIMO," and "OFDMA" appear nowhere in Qi. In contrast, the term "single-user" appears four times in Qi. There is no indication that Qi envisioned multi-user transmissions; the system described in Qi is a single-user system.

459. For these reasons, it is my opinion that Dr. Hansen has not shown Qi teaches or suggests Element 1[pre].

9.7.3.2 Element 1 [a]: interleaving a plurality of data units for the plurality of STAs based on sizes of the plurality of resource units allocated to the plurality of STAs to generate a plurality of interleaved data units; and

460. Dr. Hansen states that Qi teaches Element 1[a]. Hansen Report at ¶¶903-05. I disagree.

461. Dr. Hansen cites Qi at ¶¶ [0025], and [0029].

462. Element 1[a] requires "resource units allocated to the plurality of STAs." Dr. Hansen does not explain what in these passages he believes discloses "resource units allocated to the plurality of STAs."

463. The passages Dr. Hansen cites do not mention "data units," so it appears that his theory of what constitutes a "resource unit" may have changed as compared with Element 1[pre]. This lack of internal consistency underscores the problems with his invalidity theory.

464. Qi at ¶ [0029] states "In a MIMO OFDM system, such as the WLAN 10 of FIG. 1, interleaver parameter selection depends, for example, on the number of data subcarriers in an OFDM symbol and the number of spatial streams being utilized in the particular communication channel."

465. It appears that Dr. Hansen may believe that the "number of data subcarriers" or the "number of spatial streams" is the claimed "resource units." However, these cannot be the claimed resource units because the cited passages do not disclose subcarriers or spatial streams being "allocated to a plurality of STAs." There is no disclosure of multi-user

[redacted]

operation in any of the cited passages. Rather, in Qi, all data subcarriers and all spatial streams are allocated to the same STA, because Qi only discusses single-user operation and does not describe multi-user operation, as I explained above at 1[pre].

466. For these reasons, it is my opinion that Dr. Hansen has not shown Qi teaches or suggests Element 1[a].

9.7.3.3 Element 1 [b]: transmitting, through the transmission channel, a Physical layer Protocol Data Unit (PPDU) frame including the plurality of interleaved data units respectively on the plurality of resource units to the plurality of STAs,

467. Dr. Hansen states that Qi teaches Element 1[b]. Hansen Report at ¶¶920-22. I disagree.

468. Dr. Hansen cites Qi at ¶¶ [0005], [0019].

469. Dr. Hansen's invalidity theory for this claim element suffers from the same defects I described above at Elements 1[pre], 1[a], and 1[b]. Specifically, he has failed to identify what he believes are the claimed "resource units," and he has not shown that any PPDU is transmitted "on the plurality of resource units to the plurality of STAs." Because Qi is a single-user system that does not disclose multi-user operation, he cannot show that this claim limitation is disclosed by Qi.

470. I further incorporate here my opinions about why Dr. Hansen has not shown Qi discloses Elements 1[pre], 1[a], and 1[b].

471. For these reasons, it is my opinion that Dr. Hansen has not shown Qi teaches or suggests Element 1[b].

9.7.3.4 Element 1 [d]: wherein the interleaving of the plurality of data units for the plurality of STAs comprises: when the size of the resource unit allocated to the first STA is the first size, interleaving a data unit for the first STA using a first set of interleaving parameter values; and

472. Dr. Hansen states that Qi teaches Element 1[d]. Hansen Report at ¶¶949-952. I disagree.

473. Dr. Hansen cites Qi at ¶¶ [0005], [0019], [0029].

[redacted]

474. Dr. Hansen's invalidity theory for this claim element suffers from the same defects I described above at Elements 1[pre], 1[a], and 1[b]. Specifically, he has failed to identify what he believes are the claimed "resource units" and "plurality of STAs." Because Qi is a single-user system that does not disclose multi-user operation, he cannot show that this claim limitation is disclosed by Qi.

475. I further incorporate here my opinions about why Dr. Hansen has not shown Qi discloses Elements 1[pre], 1[a], and 1[b].

476. Dr. Hansen also has not identified any "first size or "first set of interleaving parameter values" in the cited paragraphs of Qi.

477. For these reasons, it is my opinion that Dr. Hansen has not shown Qi teaches or suggests Element 1[d].

9.7.3.5 Element 1 [e]: when the size of the resource unit allocated to the first STA is the second size, interleaving the data unit for the first STA using a second set of interleaving parameter values, and

478. Dr. Hansen states that Qi teaches Element 1[e]. Hansen Report at ¶¶963-64. I disagree.

479. Dr. Hansen cites Qi at ¶¶ [0029].

480. Dr. Hansen's invalidity theory for this claim element suffers from the same defects I described above at Elements 1[pre], 1[a], and 1[b]. Specifically, he has failed to identify what he believes are the claimed "resource units" and "plurality of STAs." Because Qi is a single-user system that does not disclose multi-user operation, he cannot show that this claim limitation is disclosed by Qi.

481. I further incorporate here my opinions about why Dr. Hansen has not shown Qi discloses Elements 1[pre], 1[a], and 1[b].

482. Dr. Hansen also has not identified any "second size or "second set of interleaving parameter values" in the cited paragraphs of Qi.

[redacted]

483. For these reasons, it is my opinion that Dr. Hansen has not shown Qi teaches or suggests Element 1[e].

9.7.3.6 Element 1 [f]: wherein the first size is smaller than a size of the transmission channel, the second size is smaller than the first size, and the second set of interleaving parameter values is different from the first set of interleaving parameter value.

484. Dr. Hansen states that Qi teaches Element 1[f]. Hansen Report at ¶¶976-77. I disagree.

485. Dr. Hansen cites Qi at ¶¶ [0029].

486. As I explained above at Elements 1[d] and 1[e], Dr. Hansen has not identified any "first size," "second size," "first set of interleaving parameter values," or "second set of interleaving parameter values."

487. I further incorporate here my opinions about why Dr. Hansen has not shown Qi discloses Elements 1[d] and 1[e].

488. Qi at ¶¶ [0029] says "interleaver parameter selection depends, for example, on the number of data subcarriers in an OFDM symbol and the number of spatial streams being utilized in the particular communication channel," but the cited passage does not disclose any first size or second size, nor does it disclose a first or second set of interleaving parameter values.

489. The cited passage also does not disclose "the first size is smaller than a size of the transmission channel" because no first size is disclosed in the cited passage, and no size smaller than the size of the transmission channel is disclosed in the cited passage.

490. For these reasons, it is my opinion that Dr. Hansen has not shown Qi teaches or suggests Element 1[f].

9.7.3.7 Claim 3: The method according to claim 2, wherein the number of tones allocated to said each of the plurality of resource units includes a number of tones used for complex data and a number of tones used for pilot in said each of the plurality of resource units.

491. Dr. Hansen states that Qi teaches Claim 2. Hansen Report at ¶¶991-93. I disagree.

[redacted]

492. Dr. Hansen cites Qi at ¶¶ [0032], [0040].

493. As I explained above at Elements 1[pre], 1[a], and 1[b], Dr. Hansen has not shown that Qi discloses "resource units."

494. I further incorporate here my opinions about why Dr. Hansen has not shown Qi discloses Elements 1[pre], 1[a], and 1[b].

495. Additionally, the cited passages do not mention "resource units" and do not mention "pilot" tones.

496. For these reasons, it is my opinion that Dr. Hansen has not shown Qi teaches or suggests Claim 3.

9.7.3.8 Element 4 [a]: The method according to claim 1, wherein the set of sizes available to the resource unit allocated to the first STA among the plurality of STAs further includes a third size,

497. Dr. Hansen states that Qi teaches Element 4[a]. Hansen Report at ¶¶1023-35. I disagree.

498. Dr. Hansen cites Qi at ¶¶ [0031], [0045]

499. As I explained above at Elements 1[pre], 1[a], and 1[b], Dr. Hansen has not shown that Qi discloses "resource units."

500. I further incorporate here my opinions about why Dr. Hansen has not shown Qi discloses Elements 1[pre], 1[a], and 1[b].

501. Additionally, Dr. Hansen does not explain what is the alleged "third size" in the cited passages.

502. For these reasons, it is my opinion that Dr. Hansen has not shown Qi teaches or suggests Element 4[a].

[redacted]

9.7.3.9 Element 4 [b]: wherein the interleaving of the plurality of data units for the plurality of STAs further comprises: when the size of the resource unit allocated to the first STA is the third size, interleaving the data unit for the first STA using a third set of interleaving parameter values, and

503. Dr. Hansen states that Qi teaches Element 4[b]. Hansen Report at ¶¶1037-39. I disagree.

504. Dr. Hansen cites Qi at ¶¶ [0031], [0045]

505. As I explained above at Elements 1[pre], 1[a], and 1[b], Dr. Hansen has not shown that Qi discloses "resource units."

506. I further incorporate here my opinions about why Dr. Hansen has not shown Qi discloses Elements 1[pre], 1[a], and 1[b].

507. Additionally, Dr. Hansen does not explain what is the alleged "third size" in the cited passages.

508. Additionally, Dr. Hansen does not identify any "third set of interleaving parameter values" in the cited passages. The cited passages refer to a "a third permutation" being performed in the interleaving operation, but this is not related to the claimed "third set of interleaving parameter values." The third permutation is an operation performed during interleaving and is not a "parameter value." Moreover, the third permutation has nothing to do with any "third size" as required by the claim.

509. For these reasons, it is my opinion that Dr. Hansen has not shown Qi teaches or suggests Element 4[b].

9.7.3.10 Element 4 [c]: wherein the third size is smaller than the second size, and the third set of interleaving parameter values is different from the second set of interleaving parameter values.

510. Dr. Hansen states that Qi teaches Element 4[c]. Hansen Report at ¶¶1050-52. I disagree.

511. Dr. Hansen cites Qi at ¶¶ [0031], [0045].

512. As I explained above at Elements 1[pre], 1[a], and 1[b], Dr. Hansen has not shown that Qi discloses "resource units."

[redacted]

513. As I explained above at Elements 1[e], and 1[f], Dr. Hansen has not shown that Qi discloses any "second size" or "second set of interleaving parameter values."

514. Additionally, as I discuss at Elements 4[a] and 4[b], Dr. Hansen does not explain what is the alleged "third size" in the cited passages.

515. As I discuss at Element 4[b], Dr. Hansen does not identify any "third set of interleaving parameter values" in the cited passages. The cited passages refer to a "a third permutation" being performed in the interleaving operation, but this is not related to the claimed "third set of interleaving parameter values." The third permutation is an operation performed during interleaving and is not a "parameter value." Moreover, the third permutation has nothing to do with any "third size" as required by the claim.

516. I further incorporate here my opinions about why Dr. Hansen has not shown Qi discloses Elements 1[pre], 1[a], 1[b], 1[e], 1[f], 4[a] and 4[b].

517. Additionally, Dr. Hansen does not explain how or why the "third size is smaller than the second size" and the "third set of interleaving parameter values is different from the second set of interleaving parameter values."

518. For these reasons, it is my opinion that Dr. Hansen has not shown Qi teaches or suggests Element 4[c].

9.7.3.11 Claim 7: The method according to claim 1, wherein the interleaving of the plurality of data units for the plurality of STAs comprises: when the size of the resource unit allocated to the first STA is 24 data tones, interleaving the data unit for the first STA using a block interleaver having 8 columns.

519. Dr. Hansen states that Qi teaches Claim 7. Hansen Report at ¶¶1102-04. I disagree.

520. Dr. Hansen cites Qi at ¶ [0032].

521. As I explained above at Elements 1[pre], 1[a], and 1[b], Dr. Hansen has not shown that Qi discloses "resource units."

522. I further incorporate here my opinions about why Dr. Hansen has not shown Qi discloses Elements 1[pre], 1[a], and 1[b].

[redacted]

523. The cited passage of Qi does not mention "24 data tones" nor does it mention the number of interleaver columns, nor does it specify "8 columns."

524. For these reasons, it is my opinion that Dr. Hansen has not shown Qi teaches or suggests Claim 7.

9.7.3.12 Element 10 [pre]: A method for receiving data from an Access Point (AP) through a transmission channel by a first Station (STA) among a plurality of STAs in a Wireless Local Area Network (WLAN) system, wherein the transmission channel is divided into a plurality of resource units which are allocated to the plurality of STAs respectively, the method comprising:

525. Dr. Hansen states that Qi teaches Element 10[pre]. Hansen Report at ¶¶1163-66. I disagree.

526. Dr. Hansen cites Qi at ¶¶ [0015], [0016], [0019]. These are the same passages Dr. Hansen cited regarding element 1[pre]. As I explained above, Dr. Hansen has not shown that the cited passages disclose "resource units which are allocated to the plurality of STAs respectively."

527. I further incorporate here my opinions about why Dr. Hansen has not shown Qi discloses Element 1[pre].

528. For these reasons, it is my opinion that Dr. Hansen has not shown Qi teaches or suggests Element 10[pre].

9.7.3.13 Element 10 [a]: receiving, through the transmission channel, a Physical layer Protocol Data Unit (PPDU) frame including a plurality of data units for the plurality of STAs respectively on the plurality of resource units to acquire a data unit for the first STA from a resource units allocated to the first STA; and

529. Dr. Hansen states that Qi teaches Element 10[a]. Hansen Report at ¶¶1184-87. I disagree.

530. Dr. Hansen cites Qi at ¶¶ [0005], [0019]. These are the same passages Dr. Hansen cited regarding element 1[b]. As I explained above, Dr. Hansen has not shown that the

[redacted]

cited passages disclose "a plurality of data units for the plurality of STAs respectively on the plurality of resource units."

531. I further incorporate here my opinions about why Dr. Hansen has not shown Qi discloses Elements 1[a] and 1[b].

532. For these reasons, it is my opinion that Dr. Hansen has not shown Qi teaches or suggests Element 10[a].

9.7.3.14 Element 10 [d]: wherein the deinterleaving of the data unit for the STA comprises: when the size of resource unit allocated to the first STA is the first size, deinterleaving the data unit for the first STA using a first set of interleaving parameter values; and

533. Dr. Hansen states that Qi teaches Element 10[d]. Hansen Report at ¶¶1245-49. I disagree.

534. Dr. Hansen cites Qi at ¶¶ [0029], [0036], [0037]. Dr. Hansen has not identified any "resource unit," "first size," or "first set of interleaving parameter values" in the cited paragraphs of Qi.

535. I further incorporate here my opinions about why Dr. Hansen has not shown Qi discloses Element 1[d].

536. For these reasons, it is my opinion that Dr. Hansen has not shown Qi teaches or suggests Element 10[d].

9.7.3.15 Element 10 [e]: when the size of resource unit allocated to the first STA is the second size, deinterleaving the data unit for the first STA using a second set of interleaving parameter values; and values, and

537. Dr. Hansen states that Qi teaches Element 10[e]. Hansen Report at ¶¶1266-70. I disagree.

538. Dr. Hansen cites Qi at ¶¶ [0029], [0036], [0037]. Dr. Hansen has not identified any "resource unit," "second size," or "second set of interleaving parameter values" in the cited paragraphs of Qi.

[redacted]

539. I further incorporate here my opinions about why Dr. Hansen has not shown Qi discloses Element 1[e].

540. For these reasons, it is my opinion that Dr. Hansen has not shown Qi teaches or suggests Element 10[e].

9.7.3.16 Element 10 [f]: wherein the first size is smaller than a size of the transmission channel, the second size is smaller than the first size, and the second set of interleaving parameter values is different from the first set of interleaving parameter values.

541. Dr. Hansen states that Qi teaches Element 10[f]. Hansen Report at ¶¶1287-91. I disagree.

542. Dr. Hansen cites Qi at ¶¶ [0029], [0036], [0037]. Dr. Hansen has not identified any "resource unit," "first size," "second size," "first set of interleaving parameter values," or "second set of interleaving parameter values" in the cited paragraphs of Qi.

543. I further incorporate here my opinions about why Dr. Hansen has not shown Qi discloses Element 1[f].

544. For these reasons, it is my opinion that Dr. Hansen has not shown Qi teaches or suggests Element 10[f].

9.7.3.17 Element 12 [a]: The method according to claim 10, wherein the set of sizes available to the resource unit allocated to the first STA further includes a third size,

545. Dr. Hansen states that Qi teaches Element 12[a]. Hansen Report at ¶¶1330-32. I disagree.

546. Dr. Hansen cites Qi at ¶ [0029]. This is the same paragraph he cited regarding Elements 1[e], 1[f], and 10[f]. As I explained above, Dr. Hansen has not identified any "first size," "second size," "first set of interleaving parameter values," or "second set of interleaving parameter values" in this paragraph. Likewise, he has not identified any "third size" or "third set of interleaving parameters" in this paragraph.

[redacted]

547. I further incorporate here my opinions about why Dr. Hansen has not shown Qi discloses Element 1[e], 4[a], 1[f], and 10[f].

548. For these reasons, it is my opinion that Dr. Hansen has not shown Qi teaches or suggests Element 12[a].

9.7.3.18 Element 12 [b]: wherein the deinterleaving of the data unit for the first STA further comprises, when the size of the resource unit allocated to the first STA is the third size, deinterleaving the data unit for the first STA using a third set of interleaving parameter values, and

549. Dr. Hansen states that Qi teaches Element 12[b]. Hansen Report at ¶¶1348-50. I disagree.

550. Dr. Hansen cites Qi at ¶ [0029]. This is the same paragraph he cited regarding Elements 1[e], 1[f], and 10[f]. As I explained above, Dr. Hansen has not identified any "first size," "second size," "first set of interleaving parameter values," or "second set of interleaving parameter values" in this paragraph. Likewise, he has not identified any "third size" or "third set of interleaving parameters" in this paragraph.

551. I further incorporate here my opinions about why Dr. Hansen has not shown Qi discloses Element 1[e], 4[b], 1[f], and 10[f].

552. For these reasons, it is my opinion that Dr. Hansen has not shown Qi teaches or suggests Element 12[b].

9.7.3.19 Element 12 [c]: wherein the third size is smaller than the second size, and the third set of interleaving parameter values is different from the second set of interleaving parameter values.

553. Dr. Hansen states that Qi teaches Element 12[c]. Hansen Report at ¶¶1367-69. I disagree.

554. Dr. Hansen cites Qi at ¶ [0029]. This is the same paragraph he cited regarding Elements 1[e], 1[f], and 10[f]. As I explained above, Dr. Hansen has not identified any "first size," "second size," "first set of interleaving parameter values," or "second set of interleaving parameter values" in this paragraph. Likewise, he has not identified any "third

[redacted]

size" or "third set of interleaving parameters" in this paragraph. Likewise, he has not identified any differences between a "third size," a "second size," a "third set of interleaving parameter values," and a "second set of interleaving parameter values."

555. I further incorporate here my opinions about why Dr. Hansen has not shown Qi discloses Element 1[e], 4[c], 1[f], and 10[f].

556. For these reasons, it is my opinion that Dr. Hansen has not shown Qi teaches or suggests Element 12[c].

9.7.3.20 Element 14 [pre]: A method for receiving data from an Access Point (AP) through a transmission channel by a first Station (STA) among a plurality of STAs in a Wireless Local Area Network (WLAN) system, wherein the transmission channel is divided into a plurality of OFDMA resource units which are allocated to the plurality of STAs respectively, the method comprising:

557. Dr. Hansen states that Qi teaches Element 14[pre]. Hansen Report at ¶¶1409-12. I disagree.

558. Dr. Hansen cites Qi at ¶¶ [0015], [0019]. These are the same passages Dr. Hansen cited regarding Elements 1[pre] and 10[pre]. As I explained above, Dr. Hansen has not shown that the cited passages disclose "resource units which are allocated to the plurality of STAs respectively."

559. I further incorporate here my opinions about why Dr. Hansen has not shown Qi discloses Element 1[pre] and 10[pre].

560. For these reasons, it is my opinion that Dr. Hansen has not shown Qi teaches or suggests Element 14[pre].

9.7.3.21 Element 14 [a]: receiving, through the transmission channel, a Physical layer Protocol Data Unit (PPDU) frame including a plurality of data units for the plurality of STAs respectively on the plurality of OFDMA resource units to acquire a data unit for the first STA from an OFDMA resource unit allocated to the first STA; and

561. Dr. Hansen states that Qi teaches Element 14[a]. Hansen Report at ¶¶1431-34. I disagree.

[redacted]

562. Dr. Hansen cites Qi at ¶¶ [0005], [0019]. These are the same passages Dr. Hansen cited regarding element 1[b] and 10[a]. As I explained above, Dr. Hansen has not shown that the cited passages disclose "plurality of data units for the plurality of STAs respectively on the plurality of OFDMA resource units."

563. I further incorporate here my opinions about why Dr. Hansen has not shown Qi discloses Elements 1[a], 1[b], and 10[a].

564. For these reasons, it is my opinion that Dr. Hansen has not shown Qi teaches or suggests Element 14[a].

9.7.3.22 Element 14 [d]: wherein deinterleaving of the data for the first STA comprises: when the size of the OFDMA resource unit allocated to the first STA is the first size, deinterleaving the data unit for the first STA using a first set of interleaving parameter values; and

565. Dr. Hansen states that Qi teaches Element 14[d]. Hansen Report at ¶¶1494-98. I disagree.

566. Dr. Hansen cites Qi at ¶¶ [0029], [0036], [0037]. Dr. Hansen has not identified any "resource unit," "first size," or "first set of interleaving parameter values" in the cited paragraphs of Qi.

567. I further incorporate here my opinions about why Dr. Hansen has not shown Qi discloses Element 1[d] and 10[d].

568. For these reasons, it is my opinion that Dr. Hansen has not shown Qi teaches or suggests Element 14[d].

9.7.3.23 Element 14 [e]: when the size of the OFDMA resource unit allocated to the first STA is the second size, deinterleaving the data unit for the first STA using a second set of interleaving parameter values, and

569. Dr. Hansen states that Qi teaches Element 14[e]. Hansen Report at ¶¶1516-20. I disagree.

[redacted]

570. Dr. Hansen cites Qi at ¶¶ [0029], [0036], [0037]. Dr. Hansen has not identified any "resource unit," "second size," or "second set of interleaving parameter values" in the cited paragraphs of Qi.

571. I further incorporate here my opinions about why Dr. Hansen has not shown Qi discloses Element 1[e] and 10[e].

572. For these reasons, it is my opinion that Dr. Hansen has not shown Qi teaches or suggests Element 14[e].

9.7.3.24 Element 14 [f]: wherein the first size is smaller than a size of the transmission channel, the second size is smaller than the first size, and the second set of interleaving parameter values is different from the first set of interleaving parameter values.

573. Dr. Hansen states that Qi teaches Element 14[f]. Hansen Report at ¶¶1537-41. I disagree.

574. Dr. Hansen cites Qi at ¶ [0029], [0036], [0037]. Dr. Hansen has not identified any "resource unit," "first size," "second size," "first set of interleaving parameter values," or "second set of interleaving parameter values" in the cited paragraphs of Qi.

575. I further incorporate here my opinions about why Dr. Hansen has not shown Qi discloses Elements 1[f] and 10[f].

576. For these reasons, it is my opinion that Dr. Hansen has not shown Qi teaches or suggests Element 14[f].

9.7.4 802.11ac-2013 Fails To Disclose Or Render Obvious Several '187 Claim Limitations

9.7.4.1 Element 1 [pre]: A method for transmitting data to a plurality of Stations (STAs) through a transmission channel by an Access Point (AP) in a Wireless Local Area Network (WLAN) system, wherein the transmission channel is divided into a plurality of resource units which are allocated to the plurality of STAs respectively, the method comprising

577. Dr. Hansen states that 802.11ac-2013 teaches Elements 1[pre]. Hansen Report at ¶¶890-92. I disagree.

578. Dr. Hansen cites 802.11ac-2013 at 2, 6, 296.

[redacted]

579. Element 1[pre] requires “a plurality of resource units which are allocated to the plurality of STAs respectively.” Dr. Hansen does not explain what in these passages he believes discloses “a plurality of resource units which are allocated to the plurality of STAs respectively.”

580. Page 2 of 802.11ac-2013 states “an access point (AP) with more than one antenna transmits a physical layer (PHY) protocol data unit (PPDU) to multiple receiving non-AP stations (STAs) over the same radio frequencies, wherein each non-AP STA simultaneously receives one or more distinct space-time streams.” This statement describes transmitting to multiple STAs using multiple space-time streams, but using “the same radio frequencies.” In other words, separate sub-channels are ***not*** “allocated to the plurality of STAs respectively” because the PPDU is sent over “the same radio frequencies” to multiple STAs using MU MIMO.

581. Dr. Hansen may believe that the “distinct space-time streams” are the claimed “plurality of resource units which are allocated to the plurality of STAs respectively.” However, there are at least two problems with this theory.

582. First, Dr. Hansen is not consistent in his apparent invalidity theory. Later on in claim 1, as I describe below, he appears to point to different and inconsistent features of 802.11ac-2013 as “resource units.”

583. Second, resource units in the context of the ’187 Patent claims are particular units of “sub-channels” rather than spatial streams. For example, the ’187 Patent states “While the term subchannel is used in the present disclosure, the term subchannel may be referred to as Resource Unit (RU) or sub-band.” The ’187 Patent also states “The size of the subchannel allocated to the STA may be an N (N=l, 2, 3, ...) multiple of the size of the basic subchannel unit (i.e., a minimum-size subchannel unit).” *Id.* at 13:49-51. Additionally, the claims of the ’187 require, e.g., “first size [of the resource unit] is smaller than a size of the transmission channel.” *Id.* at Claim 1. These disclosures demonstrate that the claimed “resource units” in the ’187 Patent are particular basic units of subchannel

[redacted]

resources. A disclosure of "distinct space-time streams" does not disclose these basic units of subchannel resources, as required by the claims of the '187 Patent.

584. In the cited pages of 802.11ac-2013, all receiving STAs use "the same radio frequencies." Accordingly, Dr. Hansen has not shown how or why 802.11ac-2013 discloses "resource units" in the context of the '187 Patent, because the '187 Patent requires different sub-channel units to be "allocated to the plurality of STAs respectively."

585. For these reasons, it is my opinion that Dr. Hansen has not shown 802.11ac-2013 teaches or suggests Element 1[pre].

9.7.4.2 Element 1 [a]: interleaving a plurality of data units for the plurality of STAs based on sizes of the plurality of resource units allocated to the plurality of STAs to generate a plurality of interleaved data units; and

586. Dr. Hansen states that 802.11ac-2013 teaches Element 1[a]. Hansen Report at ¶¶906-10. I disagree.

587. Dr. Hansen cites 802.11ac-2013 at 2, 6, 279, Figure 22-12, and Table 22-17.

588. Element 1[a] requires "resource units allocated to the plurality of STAs." Dr. Hansen does not explain what in these passages he believes discloses "resource units allocated to the plurality of STAs."

589. Dr. Hansen is inconsistent and unclear about what he is pointing to as resource units. If Dr. Hansen believes "distinct space-time streams" are the claimed resource units, he has not explained how space time streams have "sizes." The passage he cites from page 2 of 802.11ac-2013 states that all space-time streams use "the same radio frequencies," so they would all have the same size.

590. Dr. Hansen also cites a reference to "maximum data unit sizes (in octets) and durations (in microseconds)" at Table 8.13c. He does not explain whether he believes that these "data units" are resource units. If so, this is inconsistent with his theory above for Element 1[pre]. Table 8.13c does not describe "resource units" but rather describes components of the frame body, such as MMPDU, MSDU, A-MSDU, and MPDU.

[redacted]

591. Also, nothing in Table 8.13c discloses sending "data units" to a "plurality of STAs."

592. Dr. Hansen also cites 802.11ac-2013 at 6, (this appears to be a mistake on Dr. Hansen's part, it appears he intended to cite page 7). On page 7 various primary and secondary channel sizes are recited. Dr. Hansen does not explain whether he believes these channel sizes are resource units. If so, this is inconsistent with his theory above for Element 1[pre].

593. Pages 6-7 do not describe "resource units," instead page 7 describes the width of the entire transmission channel. It does not describe any sub-division of the transmission channel such that it can be "allocated to the plurality of STAs." Page 7 does not teach multi-user operation at all, and as noted above, page 2 states that all STAs are allocated "the same radio frequencies" and not resource units or sub-channels.

594. For these reasons, it is my opinion that Dr. Hansen has not shown 802.11ac-2013 teaches or suggests Element 1[a].

9.7.4.3 Element 1 [b]: transmitting, through the transmission channel, a Physical layer Protocol Data Unit (PPDU) frame including the plurality of interleaved data units respectively on the plurality of resource units to the plurality of STAs,

595. Dr. Hansen states that 802.11ac-2013 teaches Element 1[b]. Hansen Report at ¶¶923-24. I disagree.

596. Dr. Hansen cites 802.11ac-2013 at pages 2 and 6.

597. As I explained above at Elements 1[a] and 1[b], these pages do not describe "the plurality of resource units to the plurality of STAs."

598. The cited passages do not mention "data unit sizes" or "channel sizes," so Dr. Hansen does not appear to contend that these are the claimed resource units. To the extent he claims these are resource units in the context of Element 1[a], this is yet another inconsistency in his invalidity theory.

599. I further incorporate here my opinions about why Dr. Hansen has not shown 802.11ac-2013 discloses Elements 1[pre] and 1[a].

[redacted]

600. For these reasons, it is my opinion that Dr. Hansen has not shown 802.11ac-2013 teaches or suggests Element 1[b].

9.7.4.4 Element 1 [d]: wherein the interleaving of the plurality of data units for the plurality of STAs comprises: when the size of the resource unit allocated to the first STA is the first size, interleaving a data unit for the first STA using a first set of interleaving parameter values; and

601. Dr. Hansen states that 802.11ac-2013 teaches Element 1[d]. Hansen Report at ¶¶953-55. I disagree.

602. Dr. Hansen cites 802.11ac-2013 at pages 2 and 6.

603. As I explained above at Elements 1[pre], 1[a], and 1[b], these pages do not describe the claimed "resource units" in the context of the '187 Patent. Dr. Hansen does not explain what he believes is a "resource unit" in these pages.

604. Dr. Hansen also fails to identify any "first size" in these pages, and he also fails to identify any "first set of interleaving parameter values." In fact, the cited passages do not make any reference to interleavers or interleaving parameters.

605. I further incorporate here my opinions about why Dr. Hansen has not shown 802.11ac-2013 discloses Elements 1[pre], 1[a], and 1[b].

606. For these reasons, it is my opinion that Dr. Hansen has not shown 802.11ac-2013 teaches or suggests Element 1[d].

9.7.4.5 Element 1 [e]: when the size of the resource unit allocated to the first STA is the second size, interleaving the data unit for the first STA using a second set of interleaving parameter values, and

607. Dr. Hansen states that 802.11ac-2013 teaches Element 1[e]. Hansen Report at ¶¶965-67. I disagree.

608. Dr. Hansen cites 802.11ac-2013 at pages 2 and 6.

609. As I explained above at Elements 1[pre], 1[a], and 1[b], these pages do not describe the claimed "resource units" in the context of the '187 Patent. Dr. Hansen does not explain what he believes is a "resource unit" in these pages.

[redacted]

610. Dr. Hansen also fails to identify any "second size" in these pages, and he also fails to identify any "second set of interleaving parameter values." In fact, the cited passages do not make any reference to interleavers or interleaving parameters.

611. I further incorporate here my opinions about why Dr. Hansen has not shown 802.11ac-2013 discloses Elements 1[pre], 1[a], and 1[b].

612. For these reasons, it is my opinion that Dr. Hansen has not shown 802.11ac-2013 teaches or suggests Element 1[e].

9.7.4.6 Element 1 [f]: wherein the first size is smaller than a size of the transmission channel, the second size is smaller than the first size, and the second set of interleaving parameter values is different from the first set of interleaving parameter value.

613. Dr. Hansen states that 802.11ac-2013 teaches Element 1[f]. Hansen Report at ¶¶978-80. I disagree.

614. Dr. Hansen cites 802.11ac-2013 at pages 2 and 6.

615. As I explained above at Elements 1[pre], 1[a], and 1[b], these pages do not describe the claimed "resource units" in the context of the '187 Patent. Dr. Hansen does not explain what he believes is a "resource unit" in these pages.

616. As I explained above at Elements 1[d] and 1[e], Dr. Hansen has not identified any "first size," "second size," "first set of interleaving parameter values," or "second set of interleaving parameter values."

617. I further incorporate here my opinions about why Dr. Hansen has not shown 802.11ac-2013 discloses Elements 1[d] and 1[e].

618. Dr. Hansen has also failed to show that the "first size is smaller than a size of the transmission channel." As noted above, page 2 states that all STAs are allocated "the same radio frequencies" and not resource units or sub-channels. None of the cited pages describe allocating any resource to a STA that is smaller than the size of the transmission channel bandwidth, rather 802.11ac-2013 only describes allocating the entire transmission channel bandwidth.

[redacted]

619. For these reasons, it is my opinion that Dr. Hansen has not shown 802.11ac-2013 teaches or suggests Element 1[f].

9.7.4.7 Element 4 [a]: The method according to claim 1, wherein the set of sizes available to the resource unit allocated to the first STA among the plurality of STAs further includes a third size,

620. Dr. Hansen states that 802.11ac-2013 teaches Element 4[a]. Hansen Report at ¶¶1026-28. I disagree.

621. Dr. Hansen cites 802.11ac-2013 at 2 and 6.

622. As I explained above at Elements 1[pre], 1[a], and 1[b], these pages do not describe the claimed "resource units" in the context of the '187 Patent. Dr. Hansen does not explain what he believes is a "resource unit" in these pages.

623. As I explained above at Elements 1[d] and 1[e], Dr. Hansen has not identified any "first size," "second size," "first set of interleaving parameter values," or "second set of interleaving parameter values."

624. I further incorporate here my opinions about why Dr. Hansen has not shown 802.11ac-2013 discloses Elements 1[d] and 1[e].

625. Additionally, Dr. Hansen does not explain what is the alleged "third size" in the cited passages, since he does not even identify a first or second size.

626. For these reasons, it is my opinion that Dr. Hansen has not shown 802.11ac-2013 teaches or suggests Element 4[a].

9.7.4.8 Element 4 [b]: wherein the interleaving of the plurality of data units for the plurality of STAs further comprises: when the size of the resource unit allocated to the first STA is the third size, interleaving the data unit for the first STA using a third set of interleaving parameter values, and

627. Dr. Hansen states that 802.11ac-2013 teaches Element 4[b]. Hansen Report at ¶¶1040-42. I disagree.

628. Dr. Hansen cites 802.11ac-2013 at 2 and 6.

[redacted]

629. As I explained above at Elements 1[pre], 1[a], and 1[b], these pages do not describe the claimed "resource units" in the context of the '187 Patent. Dr. Hansen does not explain what he believes is a "resource unit" in these pages.

630. As I explained above at Elements 1[d] and 1[e], Dr. Hansen has not identified any "first size," "second size," "first set of interleaving parameter values," or "second set of interleaving parameter values."

631. I further incorporate here my opinions about why Dr. Hansen has not shown 802.11ac-2013 discloses Elements 1[d] and 1[e].

632. Additionally, as I describe above at Element 4[a], Dr. Hansen does not explain what is the alleged "third size" in the cited passages.

633. Additionally, Dr. Hansen does not identify any "third set of interleaving parameter values" in the cited passages, since he does not even identify a first or second set of interleaving parameter values.

634. For these reasons, it is my opinion that Dr. Hansen has not shown 802.11ac-2013 teaches or suggests Element 4[b].

9.7.4.9 Element 4 [c]: wherein the third size is smaller than the second size, and the third set of interleaving parameter values is different from the second set of interleaving parameter values.

635. Dr. Hansen states that 802.11ac-2013 teaches Element 4[c]. Hansen Report at ¶¶1052-55. I disagree.

636. Dr. Hansen cites 802.11ac-2013 at 2 and 6.

637. As I explained above at Elements 1[pre], 1[a], and 1[b], Dr. Hansen has not shown that 802.11ac-2013 discloses the claimed "resource units."

638. As I explained above at Elements 1[e], and 1[f], Dr. Hansen has not shown that 802.11ac-2013 discloses any "second size" or "second set of interleaving parameter values."

639. Additionally, as I discuss at Elements 4[a] and 4[b], Dr. Hansen does not explain what is the alleged "third size" in the cited passages.

[redacted]

640. As I discuss at Element 4[b], Dr. Hansen does not identify any "third set of interleaving parameter values" in the cited passages.

641. I further incorporate here my opinions about why Dr. Hansen has not shown 802.11ac-2013 discloses Elements 1[pre], 1[a], 1[b], 1[e], 1[f], 4[a] and 4[b].

642. Additionally, Dr. Hansen does not explain how or why the "third size is smaller than the second size" and the "third set of interleaving parameter values is different from the second set of interleaving parameter values."

643. For these reasons, it is my opinion that Dr. Hansen has not shown 802.11ac-2013 teaches or suggests Element 4[c].

9.7.4.10 Claim 7: The method according to claim 1, wherein the interleaving of the plurality of data units for the plurality of STAs comprises: when the size of the resource unit allocated to the first STA is 24 data tones, interleaving the data unit for the first STA using a block interleaver having 8 columns.

644. Dr. Hansen states that 802.11ac-2013 teaches Claim 7. Hansen Report at ¶¶1105-07. I disagree.

645. Dr. Hansen cites 802.11ac-2013 at 259.

646. As I explained above at Elements 1[pre], 1[a], and 1[b], Dr. Hansen has not shown that 802.11ac-2013 discloses the claimed "resource units."

647. The cited passage of 802.11ac-2013 does not mention "24 data tones" nor does it mention the number of interleaver columns, nor does it specify "8 columns."

648. I further incorporate here my opinions about why Dr. Hansen has not shown 802.11ac-2013 discloses Elements 1[pre], 1[a], and 1[b].

649. For these reasons, it is my opinion that Dr. Hansen has not shown 802.11ac-2013 teaches or suggests Claim 7.

[redacted]

9.7.4.11 Element 10 [pre]: A method for receiving data from an Access Point (AP) through a transmission channel by a first Station (STA) among a plurality of STAs in a Wireless Local Area Network (WLAN) system, wherein the transmission channel is divided into a plurality of resource units which are allocated to the plurality of STAs respectively, the method comprising:

650. Dr. Hansen states that 802.11ac-2013 teaches Element 10[pre]. Hansen Report at ¶¶1167-70. I disagree.

651. Dr. Hansen cites 802.11ac-2013 at 2, 6, and 296. These are the same passages Dr. Hansen cited regarding element 1[pre]. As I explained above, Dr. Hansen has not shown that the cited passages disclose the claimed "resource units which are allocated to the plurality of STAs respectively."

652. I further incorporate here my opinions about why Dr. Hansen has not shown 802.11ac-2013 discloses Element 1[pre].

653. For these reasons, it is my opinion that Dr. Hansen has not shown 802.11ac-2013 teaches or suggests Element 10[pre].

9.7.4.12 Element 10 [a]: receiving, through the transmission channel, a Physical layer Protocol Data Unit (PPDU) frame including a plurality of data units for the plurality of STAs respectively on the plurality of resource units to acquire a data unit for the first STA from a resource units allocated to the first STA; and

654. Dr. Hansen states that 802.11ac-2013 teaches Element 10[a]. Hansen Report at ¶¶1188-90. I disagree.

655. Dr. Hansen cites 802.11ac-2013 at 2 and 6. These are the same passages Dr. Hansen cited regarding element 1[b]. As I explained above, Dr. Hansen has not shown that the cited passages disclose "a plurality of data units for the plurality of STAs respectively on the plurality of resource units."

656. I further incorporate here my opinions about why Dr. Hansen has not shown 802.11ac-2013 discloses Elements 1[pre], 1[a] and 1[b].

[redacted]

657. For these reasons, it is my opinion that Dr. Hansen has not shown 802.11ac-2013 teaches or suggests Element 10[a].

9.7.4.13 Element 10 [d]: wherein the deinterleaving of the data unit for the STA comprises: when the size of resource unit allocated to the first STA is the first size, deinterleaving the data unit for the first STA using a first set of interleaving parameter values; and

658. Dr. Hansen states that 802.11ac-2013 teaches Element 10[d]. Hansen Report at ¶¶1250-54. I disagree.

659. Dr. Hansen cites 802.11ac-2013 at 2, 6, 281. Dr. Hansen has not identified any "resource unit," "first size," or "first set of interleaving parameter values" in the cited paragraphs of 802.11ac-2013.

660. I further incorporate here my opinions about why Dr. Hansen has not shown 802.11ac-2013 discloses Element 1[d].

661. For these reasons, it is my opinion that Dr. Hansen has not shown 802.11ac-2013 teaches or suggests Element 10[d].

9.7.4.14 Element 10 [e]: when the size of resource unit allocated to the first STA is the second size, deinterleaving the data unit for the first STA using a second set of interleaving parameter values; and values, and

662. Dr. Hansen states that 802.11ac-2013 teaches Element 10[e]. Hansen Report at ¶¶1271-75. I disagree.

663. Dr. Hansen cites 802.11ac-2013 at 2, 6, 281. Dr. Hansen has not identified any "resource unit," "second size," or "second set of interleaving parameter values" in the cited paragraphs of 802.11ac-2013.

664. I further incorporate here my opinions about why Dr. Hansen has not shown 802.11ac-2013 discloses Element 1[e].

665. For these reasons, it is my opinion that Dr. Hansen has not shown 802.11ac-2013 teaches or suggests Element 10[e].

[redacted]

9.7.4.15 Element 10 [f]: wherein the first size is smaller than a size of the transmission channel, the second size is smaller than the first size, and the second set of interleaving parameter values is different from the first set of interleaving parameter values.

666. Dr. Hansen states that 802.11ac-2013 teaches Element 10[f]. Hansen Report at ¶¶1292-95. I disagree.

667. Dr. Hansen cites 802.11ac-2013 at 2 and 6. Dr. Hansen has not identified any "resource unit," "first size," "second size," "first set of interleaving parameter values," or "second set of interleaving parameter values" in the cited paragraphs of 802.11ac-2013.

668. I further incorporate here my opinions about why Dr. Hansen has not shown 802.11ac-2013 discloses Element 1[f].

669. Dr. Hansen has also failed to show that the "first size is smaller than a size of the transmission channel." As noted above, page 2 states that all STAs are allocated "the same radio frequencies" and not resource units or sub-channels. None of the cited pages describe allocating any resource to a STA that is smaller than the size of the transmission channel bandwidth, rather 802.11ac-2013 only describes allocating the entire transmission channel bandwidth.

670. For these reasons, it is my opinion that Dr. Hansen has not shown 802.11ac-2013 teaches or suggests Element 10[f].

9.7.4.16 Element 12 [a]: The method according to claim 10, wherein the set of sizes available to the resource unit allocated to the first STA further includes a third size,

671. Dr. Hansen states that 802.11ac-2013 teaches Element 12[a]. Hansen Report at ¶¶1333-36. I disagree.

672. Dr. Hansen cites 802.11ac-2013 at 2 and 6. These are the same pages he cited regarding Elements 1[d], 1[e], 1[f], 4[a], and 10[f]. As I explained above, Dr. Hansen has not identified any "first size," "second size," "first set of interleaving parameter values," or "second set of interleaving parameter values" in these pages. Likewise, he has not identified any "third size" or "third set of interleaving parameters" in these pages.

[redacted]

673. I further incorporate here my opinions about why Dr. Hansen has not shown 802.11ac-2013 discloses Element 1[d], 1[e], 1[f], 4[a], and 10[f].

674. For these reasons, it is my opinion that Dr. Hansen has not shown 802.11ac-2013 teaches or suggests Element 12[a].

9.7.4.17 Element 12 [b]: wherein the deinterleaving of the data unit for the first STA further comprises, when the size of the resource unit allocated to the first STA is the third size, deinterleaving the data unit for the first STA using a third set of interleaving parameter values, and

675. Dr. Hansen states that 802.11ac-2013 teaches Element 12[b]. Hansen Report at ¶¶1351-55. I disagree.

676. Dr. Hansen cites 802.11ac-2013 at 2, 6, and 281. These are the same pages he cited regarding Elements 10[d] and 10[e]. As I explained above, Dr. Hansen has not identified any "first size," "second size," "first set of interleaving parameter values," or "second set of interleaving parameter values" in these pages. Likewise, he has not identified any "third size" or "third set of interleaving parameters" in these pages.

677. I further incorporate here my opinions about why Dr. Hansen has not shown 802.11ac-2013 discloses Element 1[d], 1[e], 1[f], 4[b], and 10 [d], 10[e], and 10[f].

678. For these reasons, it is my opinion that Dr. Hansen has not shown 802.11ac-2013 teaches or suggests Element 12[b].

9.7.4.18 Element 12 [c]: wherein the third size is smaller than the second size, and the third set of interleaving parameter values is different from the second set of interleaving parameter values.

679. Dr. Hansen states that 802.11ac-2013 teaches Element 12[c]. Hansen Report at ¶¶1370-73. I disagree.

680. Dr. Hansen cites 802.11ac-2013 at 2, 6. These are the same pages he cited regarding Elements 1[d], 1[e], 1[f], 4[c], and 10[f]. As I explained above, Dr. Hansen has not identified any "first size," "second size," "first set of interleaving parameter values," or "second set of interleaving parameter values" in these pages. Likewise, he has not

[redacted]

identified any "third size" or "third set of interleaving parameters" in this paragraph. Likewise, he has not identified any differences between a "third size," a "second size," a "third set of interleaving parameter values," and a "second set of interleaving parameter values."

681. I further incorporate here my opinions about why Dr. Hansen has not shown 802.11ac-2013 discloses Element 1[d], 1[e], 1[f], 4[c], and 10[f].

682. For these reasons, it is my opinion that Dr. Hansen has not shown 802.11ac-2013 teaches or suggests Element 12[c].

9.7.4.19 Element 14 [pre]: A method for receiving data from an Access Point (AP) through a transmission channel by a first Station (STA) among a plurality of STAs in a Wireless Local Area Network (WLAN) system, wherein the transmission channel is divided into a plurality of OFDMA resource units which are allocated to the plurality of STAs respectively, the method comprising:

683. Dr. Hansen states that 802.11ac-2013 teaches Element 14[pre]. Hansen Report at ¶¶1413-16. I disagree.

684. Dr. Hansen cites 802.11ac-2013 at 2, 6, and 296. These are the same passages Dr. Hansen cited regarding Elements 1[pre] and 10[pre]. As I explained above, Dr. Hansen has not shown that the cited passages disclose "resource units which are allocated to the plurality of STAs respectively."

685. I further incorporate here my opinions about why Dr. Hansen has not shown 802.11ac-2013 discloses Element 1[pre] and 10[pre].

686. For these reasons, it is my opinion that Dr. Hansen has not shown 802.11ac-2013 teaches or suggests Element 14[pre].

[redacted]

9.7.4.20 Element 14 [a]: receiving, through the transmission channel, a Physical layer Protocol Data Unit (PPDU) frame including a plurality of data units for the plurality of STAs respectively on the plurality of OFDMA resource units to acquire a data unit for the first STA from an OFDMA resource unit allocated to the first STA; and

687. Dr. Hansen states that 802.11ac-2013 teaches Element 14[a]. Hansen Report at ¶¶1435-37. I disagree.

688. Dr. Hansen cites 802.11ac-2013 at 2, 6. These are the same passages Dr. Hansen cited regarding element 1[b] and 10[a]. As I explained above, Dr. Hansen has not shown that the cited passages disclose "plurality of data units for the plurality of STAs respectively on the plurality of OFDMA resource units."

689. I further incorporate here my opinions about why Dr. Hansen has not shown 802.11ac-2013 discloses Elements 1[a], 1[b], and 10[a].

690. For these reasons, it is my opinion that Dr. Hansen has not shown 802.11ac-2013 teaches or suggests Element 14[a].

9.7.4.21 Element 14 [d]: wherein deinterleaving of the data for the first STA comprises: when the size of the OFDMA resource unit allocated to the first STA is the first size, deinterleaving the data unit for the first STA using a first set of interleaving parameter values; and

691. Dr. Hansen states that 802.11ac-2013 teaches Element 14[d]. Hansen Report at ¶¶1499-1503. I disagree.

692. Dr. Hansen cites 802.11ac-2013 at 2, 6, and 281. These are the same passages Dr. Hansen cited regarding Element 10[d]. Dr. Hansen has not identified any "resource unit," "first size," or "first set of interleaving parameter values" in the cited paragraphs of 802.11ac-2013.

693. I further incorporate here my opinions about why Dr. Hansen has not shown 802.11ac-2013 discloses Element 1[d] and 10[d].

694. For these reasons, it is my opinion that Dr. Hansen has not shown 802.11ac-2013 teaches or suggests Element 14[d].

[redacted]

9.7.4.22 Element 14 [e]: when the size of the OFDMA resource unit allocated to the first STA is the second size, deinterleaving the data unit for the first STA using a second set of interleaving parameter values, and

695. Dr. Hansen states that 802.11ac-2013 teaches Element 14[e]. Hansen Report at ¶¶1521-25. I disagree.

696. Dr. Hansen cites 802.11ac-2013 at 2, 6, and 281. These are the same passages Dr. Hansen cited regarding Element 10[e]. Dr. Hansen has not identified any "resource unit," "second size," or "second set of interleaving parameter values" in the cited paragraphs of 802.11ac-2013.

697. I further incorporate here my opinions about why Dr. Hansen has not shown 802.11ac-2013 discloses Element 1[e] and 10[e].

698. For these reasons, it is my opinion that Dr. Hansen has not shown 802.11ac-2013 teaches or suggests Element 14[e].

9.7.4.23 Element 14 [f]: wherein the first size is smaller than a size of the transmission channel, the second size is smaller than the first size, and the second set of interleaving parameter values is different from the first set of interleaving parameter values.

699. Dr. Hansen states that 802.11ac-2013 teaches Element 14[f]. Hansen Report at ¶¶1542-46. I disagree.

700. Dr. Hansen cites 802.11ac-2013 at 2, 6, and 281. These are the same passages Dr. Hansen cited regarding Element 10[d] and 10[e]. Dr. Hansen has not identified any "resource unit," "first size," "second size," "first set of interleaving parameter values," or "second set of interleaving parameter values" in the cited paragraphs of 802.11ac-2013.

701. I further incorporate here my opinions about why Dr. Hansen has not shown 802.11ac-2013 discloses Elements 1[f], 10[d], 10[e], and 10[f].

702. Dr. Hansen has also failed to show that the "first size is smaller than a size of the transmission channel." As noted above, page 2 states that all STAs are allocated "the same radio frequencies" and not resource units or sub-channels. None of the cited pages describe allocating any resource to a STA that is smaller than the size of the transmission channel

[redacted]

bandwidth, rather 802.11ac-2013 only describes allocating the entire transmission channel bandwidth.

703. For these reasons, it is my opinion that Dr. Hansen has not shown 802.11ac-2013 teaches or suggests Element 14[f].

9.7.5 Marvell Fails To Disclose Or Render Obvious Several ’187 Claim Limitations

9.7.5.1 Marvell is Not Prior Art

704. Dr. Hansen does not state in his report why he believes Marvell is prior art to the ’187 Patent, and does not attempt to show any evidence that Marvell is prior art. He does not say what statutory language he believes Marvell qualifies as prior art under, and he does not attempt to prove any date by which Marvell would have been publicly available.

705. Marvell bears the date “2015-07-12.” Even if Marvell is entitled to a July 12, 2015 priority date, which Dr. Hansen has not attempted to show or prove, it is not prior art to the ’187 Patent.

706. Marvell is not prior art to the ’187 Patent because July 12, 2015 is after the priority date of the ’187 patent, which was August 11, 2014 based on the Korean Provisional Application No. 10-2014-0103275.

707. Even if the ’187 Patent was only entitled to its US Provisional priority date (No. 62/135,094) filed March 18, 2015, Marvell would still not be prior art because July 12, 2015 is after this date.

9.7.5.2 Element 1 [pre]: A method for transmitting data to a plurality of Stations (STAs) through a transmission channel by an Access Point (AP) in a Wireless Local Area Network (WLAN) system, wherein the transmission channel is divided into a plurality of resource units which are allocated to the plurality of STAs respectively, the method comprising

708. Dr. Hansen states that Marvell teaches Elements 1[pre]. Hansen Report at ¶¶893-94. I disagree.

709. Dr. Hansen cites Marvell at slides 9, 16, 24, and 27.

[redacted]

710. Element 1[pre] requires "a plurality of resource units which are allocated to the plurality of STAs respectively." Dr. Hansen does not explain what in these passages he believes discloses "a plurality of resource units which are allocated to the plurality of STAs respectively."

711. Each of the cited slides from Marvell refers to "simulation assumptions" in which "a STA" is assigned a number of tones. None of the cited slides mention more than one STA. Nor do any of the slides mention allocating more than one resource unit in any given packet or transmission.

712. For example, slide 9 describes "simulation assumptions" where "A STA is assigned with a 52-tone block randomly." Slides 10-12 purport to show the results of that simulation. Next, slide 16 describes "simulation assumptions" where "A STA is assigned with a 26/52/106-tone blocks randomly." Slides 17-23 purport to show results of that simulation, which are different results from the ones shown on slides 10-12. This pattern repeats on slide 24, where "A STA is assigned with a 484-tone RU" and slides 25-26 purport to show simulation results. Likewise on slide 27, "A STA is assigned with a 996-tone RU" and slides 28-29 purport to show simulation results.

713. Although the above slides purport to describe various RU sizes, they do not say that any given transmission or packet can contain "a plurality" or RUs, nor do they say that the RUs can be allocated to "a plurality of STAs." Each simulation appears to describe a transmission in which a single RU size is allocated to a single STA.

714. For these reasons, it is my opinion that Dr. Hansen has not shown Marvell teaches or suggests Element 1[pre].

9.7.5.3 Element 1 [a]: interleaving a plurality of data units for the plurality of STAs based on sizes of the plurality of resource units allocated to the plurality of STAs to generate a plurality of interleaved data units; and

715. Dr. Hansen states that Marvell teaches Element 1[a]. Hansen Report at ¶¶911-12. I disagree.

[redacted]

716. Dr. Hansen cites Marvell at slides 9, 16, 24, and 27. These are the same slides he cited regarding Element 1[pre].

717. Element 1[a] requires "the plurality of resource units allocated to the plurality of STAs."

718. As I explain above at 1[pre], Dr. Hansen does not show that these slides disclose this element. Although the above slides purport to describe various RU sizes, they do not say that any given transmission or packet can contain "a plurality" or RUs, nor do they say that the RUs can be allocated to "a plurality of STAs." Each simulation appears to describe a transmission in which a single RU size is allocated to a single STA.

719. I further incorporate here my opinions about why Dr. Hansen has not shown Marvell discloses element 1[pre].

720. For these reasons, it is my opinion that Dr. Hansen has not shown Marvell teaches or suggests Element 1[a].

9.7.5.4 Element 1 [b]: transmitting, through the transmission channel, a Physical layer Protocol Data Unit (PPDU) frame including the plurality of interleaved data units respectively on the plurality of resource units to the plurality of STAs,

721. Dr. Hansen states that Marvell teaches Element 1[b]. Hansen Report at ¶¶. I disagree.

722. Dr. Hansen cites Marvell at slides 8, 9, 16, 24, and 27.

723. As I explained above at Element 1[pre], these slides do not describe transmitting a PPDU including "the plurality of resource units to the plurality of STAs." None of the above slides mention a PPDU being transmitted to more than one STA, nor do they mention a PPDU containing more than one resource unit.

724. I further note that these slides do not clearly disclose the "interleaved data units" and Dr. Hansen does not identify what he contends are the "interleaved data units." For example, slide 8 states "The interleaver (BCC) and tone mapper (LDPC) design for each size of RU is still open," and slide 8 contains many question marks "?" indicating "open"

[redacted]

or unspecified parameters. As such, Marvell does not appear to teach or enable the claimed "interleaved data units."

725. I further incorporate here my opinions about why Dr. Hansen has not shown Marvell discloses Elements 1[pre] and 1[a].

726. For these reasons, it is my opinion that Dr. Hansen has not shown Marvell teaches or suggests Element 1[b].

9.7.5.5 Element 1 [d]: wherein the interleaving of the plurality of data units for the plurality of STAs comprises: when the size of the resource unit allocated to the first STA is the first size, interleaving a data unit for the first STA using a first set of interleaving parameter values; and

727. Dr. Hansen states that Marvell teaches Element 1[d]. Hansen Report at ¶¶956-57. I disagree.

728. Dr. Hansen cites Marvell at slides 8, 9, 16, 24, and 27. These are the same slides he cited regarding Element 1[b].

729. As I explained above at Elements 1[pre], 1[a], and 1[b], Dr. Hansen has not shown where these slides describe the claimed "resource units" being allocated or transmitted to the "plurality of STAs."

730. Dr. Hansen also fails to identify any "first size" in these pages, and he also fails to identify any "first set of interleaving parameter values." As I noted above, slide 8 states "The interleaver (BCC) and tone mapper (LDPC) design for each size of RU is still open," and slide 8 contains many question marks "?" indicating "open" or unspecified parameters. As such, Marvell does not appear to teach or enable the claimed "first set of interleaving parameter values."

731. I further incorporate here my opinions about why Dr. Hansen has not shown Marvell discloses Elements 1[pre], 1[a], and 1[b].

732. For these reasons, it is my opinion that Dr. Hansen has not shown Marvell teaches or suggests Element 1[d].

[redacted]

9.7.5.6 Element 1 [e]: when the size of the resource unit allocated to the first STA is the second size, interleaving the data unit for the first STA using a second set of interleaving parameter values, and

733. Dr. Hansen states that Marvell teaches Element 1[e]. Hansen Report at ¶¶968-69. I disagree.

734. Dr. Hansen cites Marvell at slides 8, 9, 16, 24, and 27. These are the same slides he cited regarding Elements 1[b] and 1[d].

735. As I explained above at Elements 1[pre], 1[a], 1[b], and 1[d] Dr. Hansen has not shown where these slides describe the claimed "resource units" being allocated or transmitted to the "plurality of STAs."

736. Dr. Hansen also fails to identify any "second size" in these pages, and he also fails to identify any "second set of interleaving parameter values." As I noted above, slide 8 states "The interleaver (BCC) and tone mapper (LDPC) design for each size of RU is still open," and slide 8 contains many question marks "?" indicating "open" or unspecified parameters. As such, Marvell does not appear to teach or enable the claimed "second set of interleaving parameter values."

737. I further incorporate here my opinions about why Dr. Hansen has not shown Marvell discloses Elements 1[pre], 1[a], 1[b], and 1[d].

738. For these reasons, it is my opinion that Dr. Hansen has not shown Marvell teaches or suggests Element 1[e].

9.7.5.7 Element 1 [f]: wherein the first size is smaller than a size of the transmission channel, the second size is smaller than the first size, and the second set of interleaving parameter values is different from the first set of interleaving parameter value.

739. Dr. Hansen states that Marvell teaches Element 1[f]. Hansen Report at ¶¶981-82. I disagree.

740. Dr. Hansen cites Marvell at 8, 9, 16, 24, and 27. These are the same slides he cited regarding Elements 1[b], 1[d], and 1[e].

[redacted]

741. As I explained above at Elements 1[pre], 1[a], 1[b], 1[d], and 1[e] Dr. Hansen has not shown where these slides describe the claimed "resource units" being allocated or transmitted to the "plurality of STAs."

742. As I explained above at Elements 1[d] and 1[e], Dr. Hansen has not identified any "first size," "second size," "first set of interleaving parameter values," or "second set of interleaving parameter values."

743. I further incorporate here my opinions about why Dr. Hansen has not shown Marvell discloses Elements 1[d] and 1[e].

744. Dr. Hansen has also failed to show that the "first size is smaller than a size of the transmission channel" because he does not identify what is the "first size" or what is the "size of the transmission channel."

745. For these reasons, it is my opinion that Dr. Hansen has not shown Marvell teaches or suggests Element 1[f].

9.7.5.8 Element 4 [a]: The method according to claim 1, wherein the set of sizes available to the resource unit allocated to the first STA among the plurality of STAs further includes a third size,

746. Dr. Hansen states that Marvell teaches Element 4[a]. Hansen Report at ¶¶1029-31. I disagree.

747. Dr. Hansen cites Marvell at slides 8, 9, 16, 24, 27, and 30. He provides no analysis at all.

748. As I explained above at Elements 1[pre], 1[a], and 1[b], Dr. Hansen has not shown where these slides describe the claimed "resource units" being allocated or transmitted to the "plurality of STAs."

749. As I explained above at Elements 1[d] and 1[e], Dr. Hansen has not identified any "first size," "second size," "first set of interleaving parameter values," or "second set of interleaving parameter values."

750. I further incorporate here my opinions about why Dr. Hansen has not shown Marvell discloses Elements 1[d] and 1[e].

[redacted]

751. Additionally, Dr. Hansen does not explain what is the alleged "third size" in the cited passages, since he does not even identify a first or second size.

752. For these reasons, it is my opinion that Dr. Hansen has not shown Marvell teaches or suggests Element 4[a].

9.7.5.9 Element 4 [b]: wherein the interleaving of the plurality of data units for the plurality of STAs further comprises: when the size of the resource unit allocated to the first STA is the third size, interleaving the data unit for the first STA using a third set of interleaving parameter values, and

753. Dr. Hansen states that Marvell teaches Element 4[b]. Hansen Report at ¶¶1043-44. I disagree.

754. Dr. Hansen cites Marvell at slides 8, 9, 16, 24, 27, and 30. He provides no analysis at all.

755. As I explained above at Elements 1[pre], 1[a], and 1[b], Dr. Hansen has not shown where these slides describe the claimed "resource units" being allocated or transmitted to the "plurality of STAs."

756. As I explained above at Elements 1[d] and 1[e], Dr. Hansen has not identified any "first size," "second size," "first set of interleaving parameter values," or "second set of interleaving parameter values."

757. I further incorporate here my opinions about why Dr. Hansen has not shown Marvell discloses Elements 1[d] and 1[e].

758. Additionally, as I describe above at Element 4[a], Dr. Hansen does not explain what is the alleged "third size" in the cited passages.

759. Additionally, Dr. Hansen does not identify any "third set of interleaving parameter values" in the cited passages, since he does not even identify a first or second set of interleaving parameter values.

760. For these reasons, it is my opinion that Dr. Hansen has not shown Marvell teaches or suggests Element 4[b].

[redacted]

9.7.5.10 Element 4 [c]: wherein the third size is smaller than the second size, and the third set of interleaving parameter values is different from the second set of interleaving parameter values.

761. Dr. Hansen states that Marvell teaches Element 4[c]. Hansen Report at ¶¶1056-57. I disagree.

762. Dr. Hansen cites Marvell at slides 8, 9, 16, 24, 27, and 30. He provides no analysis at all.

763. As I explained above at Elements 1[pre], 1[a], and 1[b], Dr. Hansen has not shown where these slides describe the claimed "resource units" being allocated or transmitted to the "plurality of STAs."

764. As I explained above at Elements 1[e], and 1[f], Dr. Hansen has not shown that Marvell discloses any "second size" or "second set of interleaving parameter values."

765. Additionally, as I discuss at Elements 4[a] and 4[b], Dr. Hansen does not explain what is the alleged "third size" in the cited passages.

766. As I discuss at Element 4[b], Dr. Hansen does not identify any "third set of interleaving parameter values" in the cited passages.

767. I further incorporate here my opinions about why Dr. Hansen has not shown Marvell discloses Elements 1[pre], 1[a], 1[b], 1[e], 1[f], 4[a] and 4[b].

768. Additionally, Dr. Hansen does not explain how or why the "third size is smaller than the second size" and the "third set of interleaving parameter values is different from the second set of interleaving parameter values."

769. For these reasons, it is my opinion that Dr. Hansen has not shown Marvell teaches or suggests Element 4[c].

[redacted]

9.7.5.11 [8B] when an index of a bit input for interleaving is k, an index i and an index j are calculated by the following equations [...], i is an index obtained by applying a first permutation to the index k, j is an index obtained by applying a second permutation to the index i,

770. Claim 8 of the '187 Patent requires Element 8[B]. The equations required by Element 8[B] are:

$$i = N_{ROW}(k \bmod N_{COL}) + \left\lfloor \frac{k}{N_{COL}} \right\rfloor, k = 0, 1, \ldots , N_{CBPSSI} - 1$$

$$j = s\left\lfloor \frac{i}{s} \right\rfloor + \left(i + N_{CBPSSI} - \left\lfloor \frac{N_{COL} \cdot i}{N_{CBPSSI}} \right\rfloor\right) \bmod s,$$

$$i = 0, 1, \ldots , N_{CBPSSI} - 1$$

$$s = \max\left\{1, \frac{N_{BPSCS}}{2}\right\}$$

771. Dr. Hansen states that Marvell teaches Element 8[B]. Hansen Report at ¶¶1128-29. I disagree.

772. Dr. Hansen cites Marvell at slides 9, 13, and 34. He provides no analysis at all.

773. None of the slides cited by Dr. Hansen include any equations, let alone the specific equations required by this claim limitation. It is unclear why Dr. Hansen believes these slides disclose this limitation. In my opinion, none of the equations required by Element 8[B] are disclosed.

774. For these reasons, it is my opinion that Dr. Hansen has not shown Marvell teaches or suggests Element 8[B].

9.7.5.12 Element 10 [pre]: A method for receiving data from an Access Point (AP) through a transmission channel by a first Station (STA) among a plurality of STAs in a Wireless Local Area Network (WLAN) system, wherein the transmission channel is divided into a plurality of resource units which are allocated to the plurality of STAs respectively, the method comprising:

775. Dr. Hansen states that Marvell teaches Element 10[pre]. Hansen Report at ¶¶1171-72. I disagree.

[redacted]

776. Dr. Hansen cites Marvell at slides 9, 16, 24, and 27. These are the same passages Dr. Hansen cited regarding element 1[pre].

777. As I explained above, Dr. Hansen does not explain what in these passages he believes discloses "a plurality of resource units which are allocated to the plurality of STAs respectively."

778. I further incorporate here my opinions about why Dr. Hansen has not shown Marvell discloses Element 1[pre].

779. For these reasons, it is my opinion that Dr. Hansen has not shown Marvell teaches or suggests Element 10[pre].

9.7.5.13 Element 10 [a]: receiving, through the transmission channel, a Physical layer Protocol Data Unit (PPDU) frame including a plurality of data units for the plurality of STAs respectively on the plurality of resource units to acquire a data unit for the first STA from a resource units allocated to the first STA; and

780. Dr. Hansen states that Marvell teaches Element 10[a]. Hansen Report at ¶¶1191-93. I disagree.

781. Dr. Hansen cites Marvell at 9, 16, 24, and 27. Dr. Hansen also cited these slides regarding elements 1[a] and 1[b]. As I explained above, Dr. Hansen has not shown that these slides describe a PPDU including "including a plurality of data units for the plurality of STAs respectively on the plurality of resource units." None of the above slides mention a PPDU being transmitted to or received by more than one STA, nor do they mention a PPDU containing more than one resource unit.

782. I further incorporate here my opinions about why Dr. Hansen has not shown Marvell discloses Elements 1[pre], 1[a] and 1[b].

783. For these reasons, it is my opinion that Dr. Hansen has not shown Marvell teaches or suggests Element 10[a].

[redacted]

9.7.5.14 Element 10 [d]: wherein the deinterleaving of the data unit for the STA comprises: when the size of resource unit allocated to the first STA is the first size, deinterleaving the data unit for the first STA using a first set of interleaving parameter values; and

784. Dr. Hansen states that Marvell teaches Element 10[d]. Hansen Report at ¶¶1255-57. I disagree.

785. Dr. Hansen cites Marvell at 8, 9, 16, 24, and 27. These are the same slides he cited regarding Element 1[d].

786. Dr. Hansen has not shown where these slides describe the claimed "resource units" being allocated or transmitted to the "plurality of STAs."

787. Dr. Hansen also fails to identify any "first size" in these pages, and he also fails to identify any "first set of interleaving parameter values."

788. I further incorporate here my opinions about why Dr. Hansen has not shown Marvell discloses Element 1[d].

789. For these reasons, it is my opinion that Dr. Hansen has not shown Marvell teaches or suggests Element 10[d].

9.7.5.15 Element 10 [e]: when the size of resource unit allocated to the first STA is the second size, deinterleaving the data unit for the first STA using a second set of interleaving parameter values; and values, and

790. Dr. Hansen states that Marvell teaches Element 10[e]. Hansen Report at ¶¶1276-78. I disagree.

791. Dr. Hansen cites Marvell at 8, 9, 16, 24, and 27. These are the same slides he cited regarding Element 1[e].

792. Dr. Hansen has not shown where these slides describe the claimed "resource units" being allocated or transmitted to the "plurality of STAs."

793. Dr. Hansen also fails to identify any "second size" in these pages, and he also fails to identify any "second set of interleaving parameter values."

[redacted]

794. I further incorporate here my opinions about why Dr. Hansen has not shown Marvell discloses Element 1[e].

795. For these reasons, it is my opinion that Dr. Hansen has not shown Marvell teaches or suggests Element 10[e].

9.7.5.16 Element 10 [f]: wherein the first size is smaller than a size of the transmission channel, the second size is smaller than the first size, and the second set of interleaving parameter values is different from the first set of interleaving parameter values.

796. Dr. Hansen states that Marvell teaches Element 10[f]. Hansen Report at ¶¶1296-98. I disagree.

797. Dr. Hansen cites Marvell at 8, 9, 16, 24, and 27. These are the same slides he cited regarding Element 1[f].

798. Dr. Hansen has not shown where these slides describe the claimed "resource units" being allocated or transmitted to the "plurality of STAs."

799. As I explained above at Elements 10[d] and 10[e], Dr. Hansen has not identified any "first size," "second size," "first set of interleaving parameter values," or "second set of interleaving parameter values."

800. I further incorporate here my opinions about why Dr. Hansen has not shown Marvell discloses Element 1[f].

801. Dr. Hansen has also failed to show that the "first size is smaller than a size of the transmission channel" because he does not identify what is the "first size" or what is the "size of the transmission channel."

802. For these reasons, it is my opinion that Dr. Hansen has not shown Marvell teaches or suggests Element 10[f].

9.7.5.17 Element 12 [a]: The method according to claim 10, wherein the set of sizes available to the resource unit allocated to the first STA further includes a third size,

803. Dr. Hansen states that Marvell teaches Element 12[a]. Hansen Report at ¶¶1337-39. I disagree.

[redacted]

804. Dr. Hansen cites Marvell at slides 8, 9, 16, 24, 27, and 30. These are the same slides he cited regarding Element 4[a]. As I explained above, Dr. Hansen has not identified any "first size," "second size," "first set of interleaving parameter values," or "second set of interleaving parameter values" in these pages. Likewise, he has not identified any "third size" or "third set of interleaving parameter values" in these pages.

805. I further incorporate here my opinions about why Dr. Hansen has not shown Marvell discloses Element 1[d], 1[e], 1[f], 4[a], and 10[f].

806. For these reasons, it is my opinion that Dr. Hansen has not shown Marvell teaches or suggests Element 12[a].

9.7.5.18 Element 12 [b]: wherein the deinterleaving of the data unit for the first STA further comprises, when the size of the resource unit allocated to the first STA is the third size, deinterleaving the data unit for the first STA using a third set of interleaving parameter values, and

807. Dr. Hansen states that Marvell teaches Element 12[b]. Hansen Report at ¶¶1356-58. I disagree.

808. Dr. Hansen cites Marvell at slides 8, 9, 16, 24, 27, and 30. These are the same slides he cited regarding Element 4[b]. As I explained above, Dr. Hansen has not identified any "first size," "second size," "first set of interleaving parameter values," or "second set of interleaving parameter values" in these pages. Likewise, he has not identified any "third size" or "third set of interleaving parameters" in these pages.

809. I further incorporate here my opinions about why Dr. Hansen has not shown Marvell discloses Element 1[d], 1[e], 1[f], 4[b], and 10 [d], 10[e], and 10[f].

810. For these reasons, it is my opinion that Dr. Hansen has not shown Marvell teaches or suggests Element 12[b].

[redacted]

9.7.5.19 Element 12 [c]: wherein the third size is smaller than the second size, and the third set of interleaving parameter values is different from the second set of interleaving parameter values.

811. Dr. Hansen states that Marvell teaches Element 12[c]. Hansen Report at ¶¶1374-76. I disagree.

812. Dr. Hansen cites Marvell at slides 8, 9, 16, 24, 27, and 30. These are the same slides he cited regarding Element 4[c]. As I explained above, Dr. Hansen has not identified any "first size," "second size," "first set of interleaving parameter values," or "second set of interleaving parameter values" in these pages. Likewise, he has not identified any "third size" or "third set of interleaving parameters" in this paragraph. Likewise, he has not identified any differences between a "third size," a "second size," a "third set of interleaving parameter values," and a "second set of interleaving parameter values."

813. I further incorporate here my opinions about why Dr. Hansen has not shown Marvell discloses Element 1[d], 1[e], 1[f], 4[c], and 10[f].

814. For these reasons, it is my opinion that Dr. Hansen has not shown Marvell teaches or suggests Element 12[c].

9.7.5.20 Element 14 [pre]: A method for receiving data from an Access Point (AP) through a transmission channel by a first Station (STA) among a plurality of STAs in a Wireless Local Area Network (WLAN) system, wherein the transmission channel is divided into a plurality of OFDMA resource units which are allocated to the plurality of STAs respectively, the method comprising:

815. Dr. Hansen states that Marvell teaches Element 14[pre]. Hansen Report at ¶¶1417-19. I disagree.

816. Dr. Hansen cites Marvell at slides 9, 16, 24, and 27. These are the same passages Dr. Hansen cited regarding Elements 1[pre] and 10[pre].

817. As I explained above, Dr. Hansen does not explain what in these passages he believes discloses "a plurality of resource units which are allocated to the plurality of STAs respectively."

[redacted]

818. I further incorporate here my opinions about why Dr. Hansen has not shown Marvell discloses Element 1[pre] and 10[pre].

819. For these reasons, it is my opinion that Dr. Hansen has not shown Marvell teaches or suggests Element 14[pre].

9.7.5.21 Element 14 [a]: receiving, through the transmission channel, a Physical layer Protocol Data Unit (PPDU) frame including a plurality of data units for the plurality of STAs respectively on the plurality of OFDMA resource units to acquire a data unit for the first STA from an OFDMA resource unit allocated to the first STA; and

820. Dr. Hansen states that Marvell teaches Element 14[a]. Hansen Report at ¶¶1438-40. I disagree.

821. Dr. Hansen cites Marvell at slides 8, 9, 16, 24, and 27. These are the same passages Dr. Hansen cited regarding element 1[b].

822. As I explained above, Dr. Hansen does not explain what in these passages he believes discloses "a plurality of data units for the plurality of STAs respectively on the plurality of OFDMA resource units."

823. I further incorporate here my opinions about why Dr. Hansen has not shown Marvell discloses Elements 1[a], 1[b], and 10[a].

824. For these reasons, it is my opinion that Dr. Hansen has not shown Marvell teaches or suggests Element 14[a].

9.7.5.22 Element 14 [d]: wherein deinterleaving of the data for the first STA comprises: when the size of the OFDMA resource unit allocated to the first STA is the first size, deinterleaving the data unit for the first STA using a first set of interleaving parameter values; and

825. Dr. Hansen states that Marvell teaches Element 14[d]. Hansen Report at ¶¶1504-06. I disagree.

826. Dr. Hansen cites Marvell at slides 8, 9, 16, 24, and 27. These are the same slides he cited regarding Elements 1[d] and 10[d].

[redacted]

827. Dr. Hansen has not shown where these slides describe the claimed "resource units" being allocated or transmitted to the "plurality of STAs."

828. Dr. Hansen also fails to identify any "first size" in these pages, and he also fails to identify any "first set of interleaving parameter values."

829. I further incorporate here my opinions about why Dr. Hansen has not shown Marvell discloses Element 1[d] and 10[d].

830. For these reasons, it is my opinion that Dr. Hansen has not shown Marvell teaches or suggests Element 14[d].

9.7.5.23 Element 14 [e]: when the size of the OFDMA resource unit allocated to the first STA is the second size, deinterleaving the data unit for the first STA using a second set of interleaving parameter values, and

831. Dr. Hansen states that Marvell teaches Element 14[e]. Hansen Report at ¶¶1526-28. I disagree.

832. Dr. Hansen cites Marvell at slides 8, 9, 16, 24, and 27. These are the same slides he cited regarding Elements 1[e] and 10[e].

833. Dr. Hansen has not shown where these slides describe the claimed "resource units" being allocated or transmitted to the "plurality of STAs."

834. Dr. Hansen also fails to identify any "second size" in these pages, and he also fails to identify any "second set of interleaving parameter values."

835. I further incorporate here my opinions about why Dr. Hansen has not shown Marvell discloses Element 1[e] and 10[e].

836. For these reasons, it is my opinion that Dr. Hansen has not shown Marvell teaches or suggests Element 14[e].

[redacted]

9.7.5.24 Element 14 [f]: wherein the first size is smaller than a size of the transmission channel, the second size is smaller than the first size, and the second set of interleaving parameter values is different from the first set of interleaving parameter values.

837. Dr. Hansen states that Marvell teaches Element 14[f]. Hansen Report at ¶¶1547-49. I disagree.

838. Dr. Hansen cites Marvell at slides 8, 9, 16, 24, and 27. These are the same slides he cited regarding Elements 1[f] and 10[f].

839. I further incorporate here my opinions about why Dr. Hansen has not shown Marvell discloses Elements 1[f], 10[d], 10[e], and 10[f].

840. Dr. Hansen has not shown where these slides describe the claimed "resource units" being allocated or transmitted to the "plurality of STAs."

841. As I explained above at Elements 10[d] and 10[e], Dr. Hansen has not identified any "first size," "second size," "first set of interleaving parameter values," or "second set of interleaving parameter values."

842. Dr. Hansen has also failed to show that the "first size is smaller than a size of the transmission channel" because he does not identify what is the "first size" or what is the "size of the transmission channel."

843. For these reasons, it is my opinion that Dr. Hansen has not shown Marvell teaches or suggests Element 14[f].

9.7.6 Dr. Hansen's Alleged '187 Prior Art—Even Collectively—Fails To Teach or Suggest Several '187 Claim Limitations, So Any Combination Fails To Render Obvious the '187 Claims

844. This chart summarizes my '187 validity analysis that is detailed above. The rows correspond to a shorthand summary of the '187 claim language, and the columns correspond to Dr. Hansen's five references for the '187 Patent: (1) Lee, (2) Choi, (3) Qi, (4) 802.11ac-2013, and (5) Marvell. In instances in which I concluded that one of Dr. Hansen's references did not teach or suggest a claim limitation, I placed a red "X" at the row/column intersection. (The absence of a red "X" does not mean that I necessarily agree

[redacted]

the reference teaches or suggests the claim limitation). I also identify the references with an X which have not been shown to be prior art to the ’187 patent.

‘187 Claim Language Shorthand	**Lee**	**Choi**	**Qi**	**802.11ac**	**Marvell**
Prior Art	**X**	**X**			**X**
1[pre] A method of transmitting a plurality of RUs to a plurality of STAs			X	X	X
1[a] interleaving a plurality of data units for the plurality of STAs based on RU sizes			X	X	X
1[b] transmitting MU PPDU with interleaved data units on RUs			X	X	X
1[c] set of RU sizes include first and second size					
1[d] when RU is the first size, interleaving with first set of interleaving parameters		X	X	X	X
1[e] when RU is the second size, interleaving with second set of interleaving parameters		X	X	X	X
1[f] first size is smaller than channel, second size is smaller than first, and first and second interleaving parameters are different		X	X	X	X
2 size of RU corresponds to number of tones					
3 each RU includes complex data tones and pilot tones		X	X		
4[a] RU sizes include third size		X	X	X	X
4[b] when RU is the third size, interleaving with third set of interleaving parameters		X	X	X	X
4[c] third size is smaller than second, and third and second interleaving parameters are different		X	X	X	X
5 interleaver depth is different for first and second set of interleaving parameters					

[redacted]

‘187 Claim Language Shorthand	Lee	Choi	Qi	802.11ac	Marvell
Prior Art	**X**	**X**			**X**
6 interleaving parameters include N_{COL}, N_{ROW}, and N_{ROT}		X			
7 first size RU includes 24 data tones and uses 8 column interleaver	X		X	X	
8 interleaver permutations must satisfy specific equations	X				X
9 N_{SS} is different values for each RU	X				
10[pre] A method of receiving a transmission with a plurality of RUs to a plurality of STAs			X	X	X
10[a] receiving MU PPDU with plurality of RUs			X	X	X
10[b] deinterleaving data for first STA based on RU size					
10[c] set of RU sizes include first and second size					
10[d] when RU is the first size, deinterleaving with first set of interleaving parameters		X	X	X	X
10[e] when RU is the second size, deinterleaving with second set of interleaving parameters		X	X	X	X
10[f] first size is smaller than channel, second size is smaller than first, and first and second interleaving parameters are different		X	X	X	X
11 size of RU corresponds to number of tones					
12[a] RU sizes include third size		X	X	X	X
12[b] when RU is the third size, deinterleaving with third set of interleaving parameters		X	X	X	X
12[c] third size is smaller than second, and third and second interleaving parameters are different		X	X	X	X
13 size of channel is 20MHz					
14[pre] A method of receiving a transmission with a plurality of RUs to a plurality of STAs			X	X	X
14[a] receiving MU PPDU with plurality of RUs			X	X	X
14[b] deinterleaving data for first STA based on RU size					
14[c] set of RU sizes include first and second size					

[redacted]

‘187 Claim Language Shorthand	**Lee**	**Choi**	**Qi**	**802.11ac**	**Marvell**
Prior Art	**X**	**X**			**X**
14[d] when RU is the first size, deinterleaving with first set of interleaving parameters		X	X	X	X
14[e] when RU is the second size, deinterleaving with second set of interleaving parameters		X	X	X	X
14[f] first size is smaller than channel, second size is smaller than first, and first and second interleaving parameters are different		X	X	X	X

845. As reflected in the Table above, Dr. Hansen has not clearly shown that any of the asserted references disclose ‘187 claim limitations. For example, Lee, Choi, and Marvell are not prior art, and no combination of Qi and 802.11ac-2013 discloses 1[pre], 1[a], 1[b], 1[d], 1[e], 1[f], 4[a], 4[b], 4[c], 7, 10[pre], 10[a], 10[d], 10[e], 10[f], 12[a], 12[b], 12[c], 14[pre], 14[a], 14[d], 14[e], 14[f], or any claims that depend from those claims. Consequently, Dr. Hansen’s alleged ‘187 prior art—even collectively, or in any combination—fails to teach or suggest every limitation of the ‘187 claims. Hence, I understand that Dr. Hansen’s ‘187 art cannot render obvious the ‘187 claims as a matter of law.

9.7.7 A POSITA would not have combined Lee, Choi, Qi, 802.11ac-2013, and/or Marvell

846. Dr. Hansen opines that “At the time of the invention, one or more of these references [*i.e.*, Lee, Choi, Qi, 802.11ac-2013, and/or Marvell] could have been combined with each other (and/or in view of applicant admitted prior art and/or the knowledge of a person of ordinary skill in the art) by a person of ordinary skill in the art in an obvious way, and a person of ordinary skill would have had a reasonable expectation of success in combining these references as described above.” *See* ¶¶1551-1562. I disagree.

847. As I explain above, Lee, Choi and Marvell are not prior art to the ’187 Patent. Accordingly, a POSITA could not have included them in any combination at the time of the ’187 invention.

[redacted]

848. Dr. Hansen in ¶ 1552 contends that "Each of these references is analogous art to the claimed invention because the references are from the same field of endeavor as the claimed invention (even if it is argued or determined that they address a different problem). For example, each of these references specifically relates to WLAN operation at least according to IEEE 802.11 standards." However, many patents and publications reference the 802.11 standard, and mere references to 802.11 does not mean that two references are analogous or compatible, nor does it mean that a POSITA would be motivated to combine them or even that it would be physically possible to combine them. A search of the PTO database shows that more than 400,000 patents and patent applications mention "802.11." Moreover, each of the five references has different dates and their references to "802.11" relate to different versions of the standard. I disagree that references to "IEEE 802.11 standards" would teach or suggest to a POSITA that the references are analogous or can be combined.

849. Dr. Hansen at ¶ 1553 states "Each of these references are analogous art to the claimed invention also because each reference is reasonably pertinent to the problem faced by the inventor (even if it is argued or determined that they are not in the same field of endeavor as the claimed invention)." He provides no evidence or analysis in support of this statement. He does not say what he believes the "problem faced by the inventor" was. In summary, he provides no support in this paragraph for his opinions.

850. In ¶ 1554, Dr. Hansen block quotes two paragraphs from Lee without explanation. Then Dr. Hansen states "And as discussed above in more detail, Lee discloses or renders obvious all elements of the Asserted Claims of the '187 Patent." I disagree with that statement, as I explained above, and Lee is not prior art to the '187 Patent.

851. Dr. Hansen states in ¶ 1555 that "Lee discloses teachings, suggestions, and motivations to use the disclosed system." He then block quotes several paragraphs from Lee without explanation or analysis. Those paragraphs generally relate to the purported benefits or improvements of Lee. Virtually every patent includes a section that discusses

[redacted]

the patent's purported benefits and improvements. The fact that Lee also includes such a section would not motivate a POSITA to combine Lee with any other reference. This type of "benefits" section would not make Lee stand out, because almost every patent includes this type of section.

852. In ¶ 1556, Dr. Hansen block quotes Choi without explanation or analysis. Those paragraphs also generally relate to the purported benefits or improvements of Choi. As I explained above, these types of paragraphs are routine in almost every patent, and would not motivate a POSITA to combine Choi with any other reference.

853. In ¶ 1557, Dr. Hansen states "A POSITA would recognize that Choi's use of different interleavers for different size RUs is analogous to Qi's use of different interleaver parameters for different bandwidths, since RU size corresponds to bandwidth." I disagree. As I explain above, the "channel bandwidth" referred to in Qi is the bandwidth of the entire channel for a SU transmission, not a resource unit (a particular sub-channel used for multi-user transmissions). The "channel bandwidth" in Qi is therefore disanalogous and would not motivate a POSITA to combine it with Lee; in fact the combination would not work in a MU system because applying Qi's interleaver to the entire channel bandwidth would scramble the data across subchannel resources such that it could not be correctly received by its intended recipient.

854. Also in ¶ 1557, Dr. Hansen states "And, similar to Lee and Choi discussed above, Qi discloses teachings, suggestions, and motivations to use its inventions in the context of IEEE 802.11 (including IEEE 802.11ax) systems and methods." As I explained above, the fact that several references mention 802.11 would not motivate a POSITA to combine the references, since hundreds of thousands of patents and other references mention 802.11, and they often related to different or even incompatible areas of technology.

855. In ¶ 1558, Dr. Hansen says "Marvell discloses an interleaver and tone mapper for OFDMA, which invention was made specifically for use in the context of IEEE 802.11ax." As I explain above, Marvell does not disclose a working interleaver. For example, slide 8

[redacted]

of Marvell states "The interleaver (BCC) and tone mapper (LDPC) design for each size of RU is still open," and slide 8 contains many question marks "?" indicating "open" or unspecified parameters. Marvell also does not disclose the relevant interleaving equations. A POSITA would not be motivated to use Marvell's unfinished and non-functional interleaver in combination with other references.

856. Dr. Hansen states in ¶1559, "The systems and methods disclosed in Lee, Choi, Qi, and Marvell are backward compatible with, and build on, 802.11ac-2013 ("Wi-Fi 5"). Accordingly, a POSITA would have been motivated to combine the teachings of any of Lee, Choi, Qi, and/or Marvell with 802.11ac-2013." But as I explain above, the fact that a reference mentions or relates to "802.11" does not provide a motivation to combine, does not mean that the references are analogous, and does not mean that a POSITA would have any reasonable expectation of combining them. There is no reason, other than impermissible hindsight, why a POSITA would view references to "802.11" as a motivation to combine these particular references.

857. In ¶ 1560, Dr. Hansen states "At the time of the invention, it would have been obvious for a POSITA to combine the teachings of any combination of the above references, using known methods as disclosed in the references, to yield predictable results." I disagree, for reasons I have discussed above. Dr. Hansen provides no evidence or analysis to support his opinions in this paragraph, and it appears he is merely reciting legal boilerplate.

858. In ¶ 1561, Dr. Hansen states "it would have been obvious at the time of the invention to combine the teachings of Lee with the teachings of 802.11ac-2013 and/or Marvell." I disagree. As I explained above, Lee and Marvell are not prior art. Moreover, Dr. Hansen's only justification for combining these references are their mentions of "802.11." As I explain above, references to the 802.11 standard are not a motivation to combine.

[redacted]

859. In ¶ 1562, Dr. Hansen states "it would have been obvious at the time of the invention to combine the teachings of Choi with the teachings of Qi, and/or Lee, and/or 802.11-ac-2013, and/or Marvell." As I explained above, Choi, Lee, and Marvell are not prior art. Moreover, Dr. Hansen's only justification for combining these references are their mentions of "802.11." As I explain above, references to the 802.11 standard are not a motivation to combine.

860. In sum, Dr. Hansen provides no technical justification for the desirability or feasibility of combining any of the references. His discussions of topics like "802.11" appear to be attempts to use hindsight to justify his preferred combinations. He also does not establish that any such combination, even if possible, would disclose all elements of any claim.

10. THE ART REFERENCED IN THE HANSEN REPORT DOES NOT INVALIDATE THE ASSERTED CLAIMS OF THE '259 PATENT

10.1 Overview of the '259 Patent

861. The '259 Patent is titled "Sounding Method." '259 Patent (ATLAS-00004620-4658, Hansen Ex. 259-1) at Title Page. It was invented by Yongjin Kwon, Hyung Park, Jongee Oh, and Inkyeong Choi while working on the next generation IEEE 802.11ax standard (aka Wi-Fi 6) at Newracom. *Id.* at 1:17-60. The '259 Patent claims priority to September 23, 2014. *Id.* at Title Page. It issued on September 12, 2017. *Id.*

862. The '259 Patent generally relates to 802.11ax MU MIMO transmissions, and more specifically to 802.11ax high efficiency (HE) sounding techniques wherein sounding feedback is transmitted by multiple stations simultaneously to an access point ("AP"). *Id.* at 1:61-2:5, 2:21-27.

863. The '259 Patent teaches a way to obtain information about the wireless channel, a procedure referred to as "channel sounding," to enable reliable OFDMA and MU-MIMO communications. In multi-user transmissions, "a given bandwidth may be divided into a plurality of subchannels and the plurality of subchannels may be allocated to multi users."

[redacted]

Id. at 1:49-51. In order to improve the quality of the multi-user transmission "a scheme such as beamforming may be applied to the plurality of subchannels." *Id.* at 1:52-54. "For this, a sounding procedure is required for the plurality of subchannels." *Id.* at 1:54-55.

864. Annotated Figures 20, 22, and 24 illustrate a preferred embodiment. In those embodiments, the beamformer (or AP) transmits a Null Data Packet Announcement ("NDPA") frame (colored green in the below figure) to each of beamformee (or STA) 1-4. That NDPA is followed by a Null Data Packet ("NDP") frame (colored blue in the below figure), also sent to each of beamformee 1-4. In response, compressed beamforming frames (colored yellow in the below figure) are sent by the beamformees 1-4 to the beamformer. Unlike the prior versions of the 802.11 standard, which did not describe or support the ability to have multiple stations transmit uplink frames at the same time as part of an uplink multi-user (UL MU) transmission, in each of these embodiments, the compressed beamforming frames are transmitted by the beamformees in parallel, that is, simultaneously:

FIG. 20

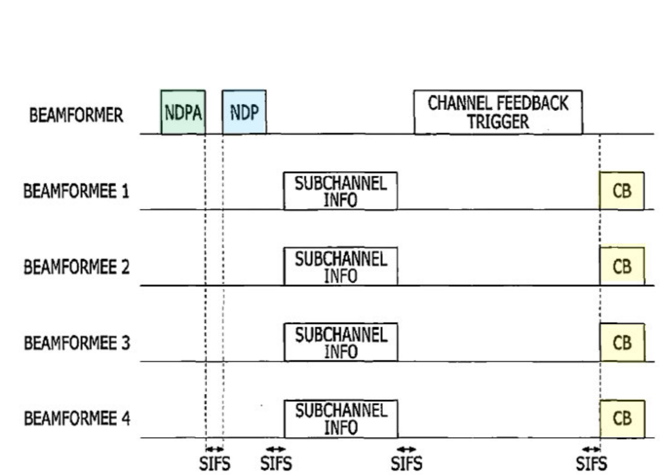
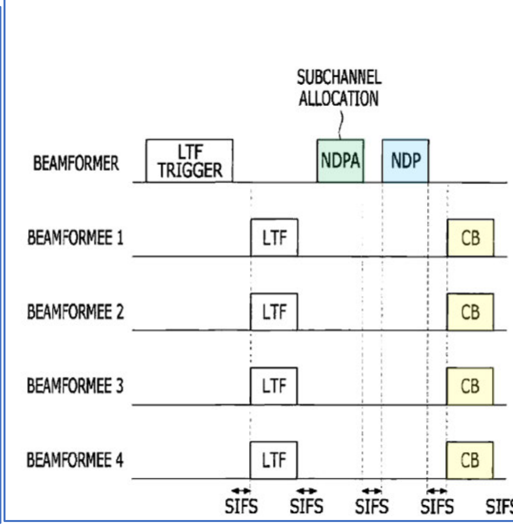
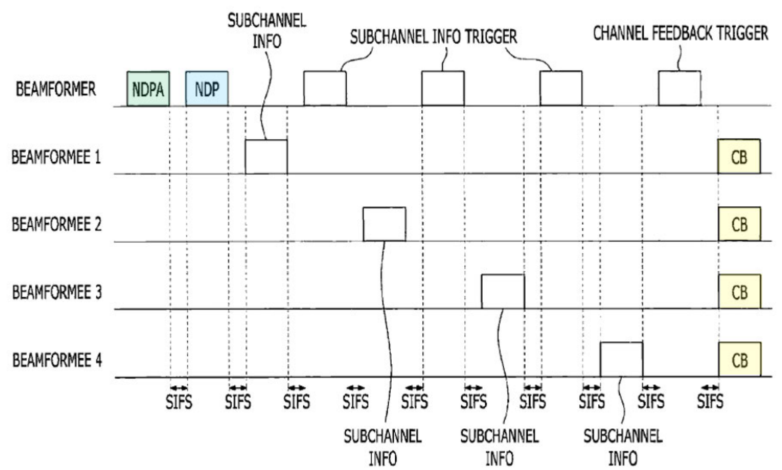


FIG. 24



[redacted]

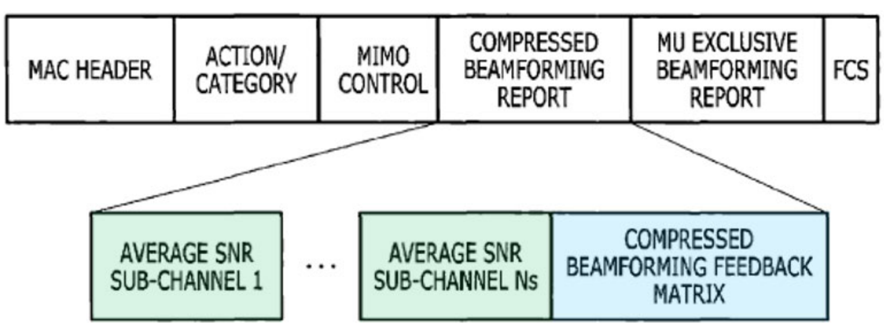
FIG. 22



’259 Figs. 20, 22, and 24 (annotations and highlighting added).

865. Figures 8, 9 10 and 11 each illustrate preferred embodiments of the contents of the compressed beamforming (“CB”) frame. The CB frame includes a compressed beamforming report field. The compressed beamforming report field may include several types of subchannel information, including the average signal-to-noise ratio (“SNR”) of one or more subchannels (colored green in the below figure) and a compressed beamforming feedback matrix (colored blue in the below figure):

FIG. 8



’259 Fig. 8

[redacted]

866. The ’259 Patent has two independent claims, claims 1 and 18. Method claim 1 is drafted from the perspective of the 802.11 station, while method claim 18 is drafted from the perspective of the 802.11 access point. I have reproduced these two independent claims below, using the same annotations as Dr. Hansen:

1[pre]. A sounding method by a first receiving device, the method comprising:

1[a] receiving a null data packet announcement (NDPA) frame from a transmitting device;

1[b] receiving a null data packet (NDP) frame from the transmitting device after receiving the NPDA frame; and

1[c] transmitting to the transmitting device a feedback frame including subchannel information measured on a first subchannel after receiving the NDP frame, the first subchannel being a subchannel that is allocated to the first receiving device among a plurality of subchannels into which a predetermined band is divided,

1[d] wherein transmitting the feedback frame includes: transmitting the feedback frame to the transmitting device while a second feedback frame including subchannel information measured on the second subchannel is transmitted to the transmitting device by a second receiving device, the second subchannel being a subchannel that is allocated to the second receiving device among the plurality of subchannels.

18[pre]. A sounding method by a transmitting device, the method comprising:

18[a] transmitting a null data packet announcement (NDPA) frame to a plurality of receiving devices;

18[b] transmitting a null data packet (NDP) frame to the plurality of receiving devices after transmitting the NPDA frame; and

18[c] receiving from each receiving device a feedback frame including subchannel information measured on a subchannel that is allocated to each receiving device among a plurality of subchannels into which a band is divided, after transmitting the NDP frame,

[redacted]

18[d] wherein the plurality of feedback frames from the plurality of receiving devices are received at a same time, and the NDPA frame includes allocation information of the plurality of subchannels.

867. Dr. Hansen provides a summary of the asserted claims of the ’259 Patent. Hansen Report at ¶133. While I generally agree with his summary and conclusion that “methods for sounding by NDPA, NDP, and feedback frames were previously known in the art,” *id.*, Dr. Hansen fails to acknowledge that both independent claims require feedback to be sent by or received from two or more stations simultaneously (i.e., “transmitting the feedback frame…while a second feedback frame…is transmitted” and “wherein the plurality of feedback frames…are received at a same time.”). ’259 Patent at 22:46-53, 24:44-47. Thus, I disagree with the implication that the methods claimed by the ’259 Patent were known in the art.

10.2 ’259 Prosecution History

868. On September 22, 2015, the Applicant filed the ’078 application with 20 initial claims. ATLAS-00004664-738.

869. On January 26, 2017, the Examiner rejected claims 1-3 and 20 the pending claims as obvious in view of Park et al. (2014/0348097) and Liu et al. (2013/0107916). ATLAS-00004664-4844. The Examiner objected to claims 4-19, but explained they would be allowable if rewritten to include all limitations of the based claim and any intervening claims. ATLAS-00004844.

870. On April 19, 2017, the Applicant and the Examiner had a telephonic interview to discuss the pending claims and the outstanding rejection, as well as a proposed claim amendment. ATLAS-00008714, 723.

871. On April 25, 2017, The Applicant amended the claims as follows:

[redacted]

1. (Currently Amended) A sounding method by a first receiving device, the method comprising:

receiving a null data packet announcement (NDPA) frame from a transmitting device;

receiving a null data packet (NDP) frame from the transmitting device after receiving the NPDA frame; and

transmitting to the transmitting device a feedback frame including subchannel information measured on a first subchannel after receiving the NDP frame, the first subchannel being a subchannel that is allocated to the first receiving device among a plurality of subchannels into which a predetermined band is divided,

wherein transmitting the feedback frame includes:

transmitting the feedback frame to the transmitting device while a second feedback frame including subchannel information measured on the second subchannel is transmitted to the transmitting device by a second receiving device, the second subchannel being a subchannel that is allocated to the second receiving device among the plurality of subchannels.

ATLAS-00008710 (highlighting added); *see also* ATLAS-00008712-713 (re then pending claim 20). The Applicant argued that the prior art did not disclose or suggest all the features of the claims, emphasizing the highlighted claim language above. ATLAS-00008714-717. On May 26, 2017, the Examiner allowed the claims. ATLAS-00008725-729.

872. Dr. Hansen provides a summary of the '259 prosecution history, which I mostly agree with. Hansen Report at ¶134. However, I note that in the April 25, 2017, amendment the applicant also added language to claim 18 explaining that "the plurality of feedback frames from the plurality of receiving devices are received at a same time, and the NDPA frame includes allocation information of the plurality of subchannels." ATLAS-00008713. And, as I noted above, only claims 1-3 and 20 were rejected as obvious in the January 26, 2017, office action.

10.3 '259 Priority Date

873. The '259 Patent claims priority to provisional application no. 62/054,270, filed on September 23, 2014:

[redacted]

Related U.S. Application Data

(60) Provisional application No. 62/054,270, filed on Sep. 23, 2014.

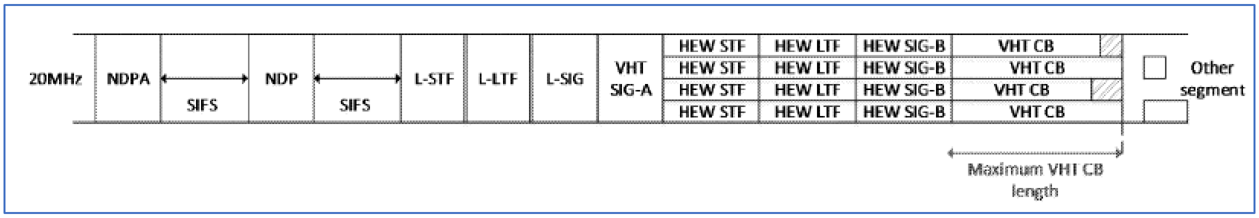
ATLAS-0004621.

874. That provisional application is titled "Sounding Procedure for OFDMA." ATLAS-00008764, ATLAS-00008773. By way of background, the Provisional explains that "OFDMA is a promising technology for enhancing user experience by serving the heterogeneous users simultaneously" "[b]ut, in order to sustain the gain, the efficient MAC protocol design is very important." ATLAS-00008775. Accordingly, "[s]ounding protocol have some unique features compared to normal SIFS response in 802.11." ATLAS-00008776.

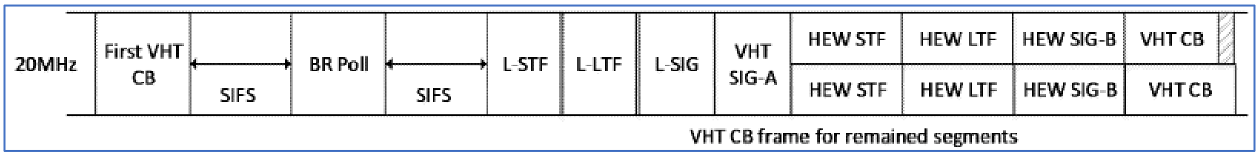
875. While the provisional application discloses several embodiments, the parallel procedure for OFDMA sounding is most relevant. *See* ATLAS-00008785. The provisional explains that the "overhead for sequential [feedback] procedure is quite large." *Id.* By using the advantages provided by OFDMA, these overhead demands can be reduced because the "CB frame also can be [sent in] parallel." *Id.* I agree.

876. The '270 Provisional describes such a parallel sounding procedure in which feedback is sent simultaneously by multiple stations. ATLAS-00008785-793. As described by the '270 Provisional, even when feedback is allocated by sub-channel, "overhead for sequential [feedback] is quite large." ATLAS-00008785. But, the provisional explains that feedback can be sent in parallel. *Id.* One technique that helps implement parallel feedback is padding the feedback frames such that all feedback frames have the same length. ATLAS-00008788-789. The provisional also explains that this maximum length can be provided in the NDPA frame. ATLAS-00008790.

[redacted]



877. The ’270 Provisional also explains that a poll frame can be sent in a multi user downlink transmission to solicit multi user feedback from the station. ATLAS-00008792.

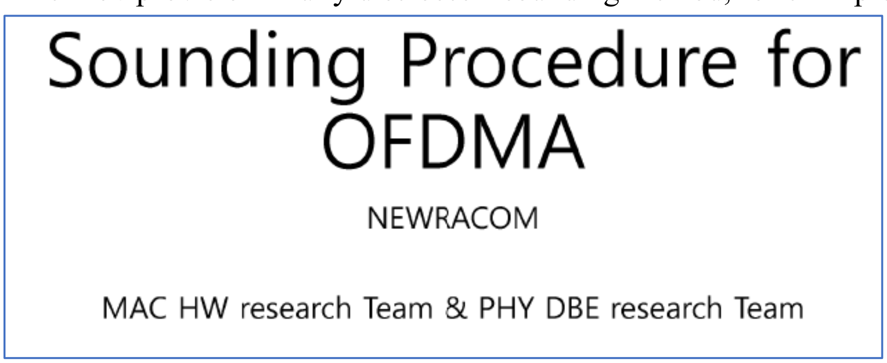


878. Dr. Hansen does not appear to dispute that the ’270 Provisional fully supports the claims of the ’259 Patent. Hansen Report ¶53. Nonetheless, in the paragraphs below, I explain on a limitation-by-limitation basis why the ’270 Provisional fully supports the claims of the ’259 Patent.

10.3.1 The ’259 Provisional Fully Supports ’259 Claim 1[PRE], 18[PRE]

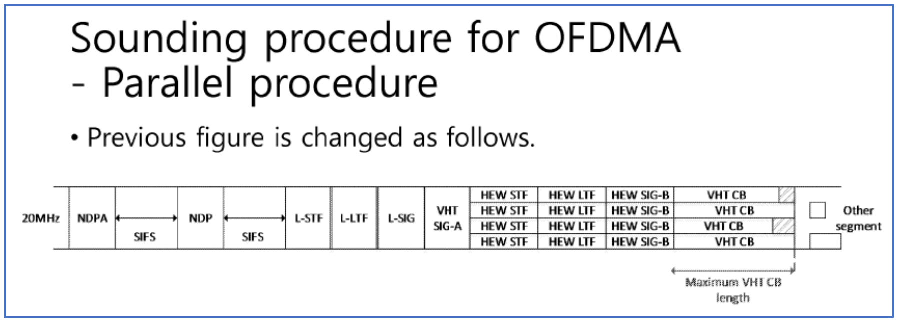
879. The preamble of ’259 claim 1 covers a sounding method by a receiving device: “A sounding method by a first receiving device.” Claim 18 is related in that it covers a sounding method by a transmitting device: “A sounding method by a transmitting device.”

880. The ’270 provisional fully discloses a sounding method, for example:



ATLAS-00008773

[redacted]

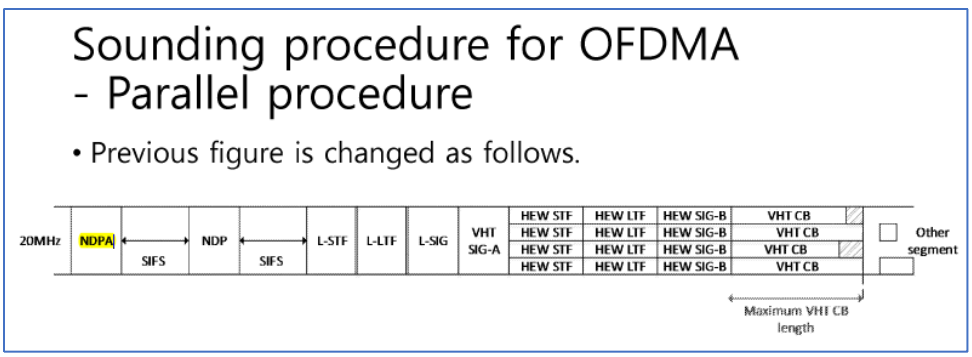


ATLAS-00008789

10.3.2 The ’259 Provisional Fully Supports ’259 Claim 1[A], 18[A]

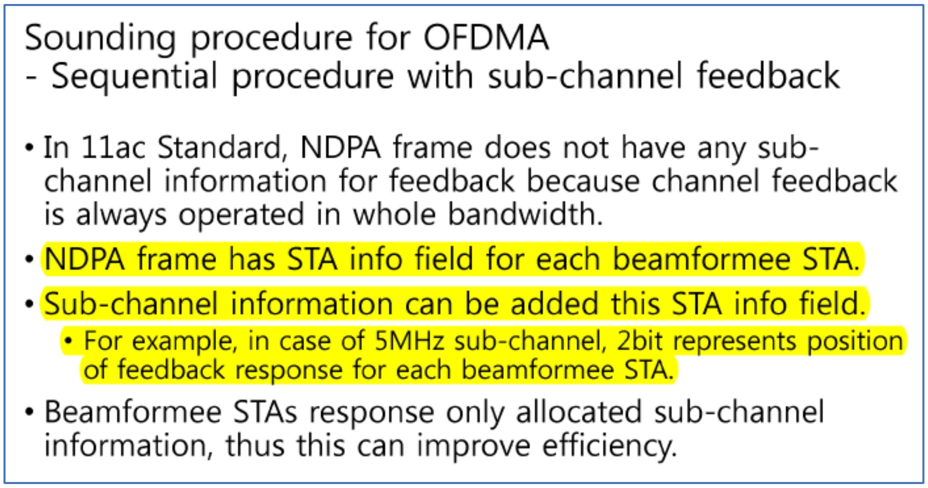
881. Limitation A of ’259 Claim 1 recites: “receiving a null data packet announcement (NDPA) frame from a transmitting device.” Limitation A of ’259 Claim 18 is related and recites: “transmitting a null data packet announcement (NDPA) frame to a plurality of receiving devices.”

882. The ’270 provisional fully discloses a null data packet announcement frame transmitted by an access point to a station:

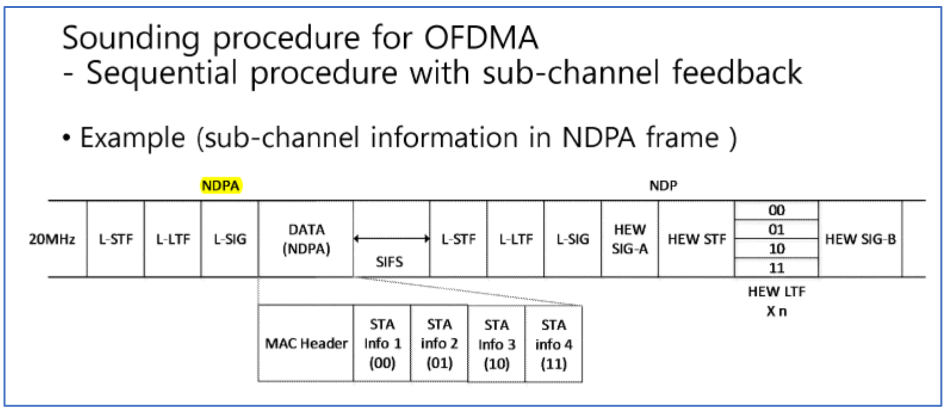


883. ATLAS-00008789. Several passages from the ’270 provisional application explain the contents of the NDPA, for example:

[redacted]



884. ATLAS-00008782



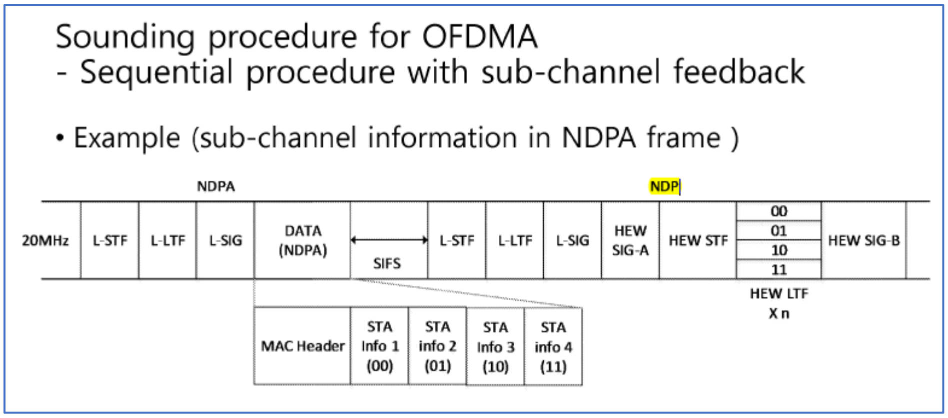
ATLAS-00008783.

10.3.3 The ’259 Provisional Fully Supports ’259 Claim 1[B], 18[B]

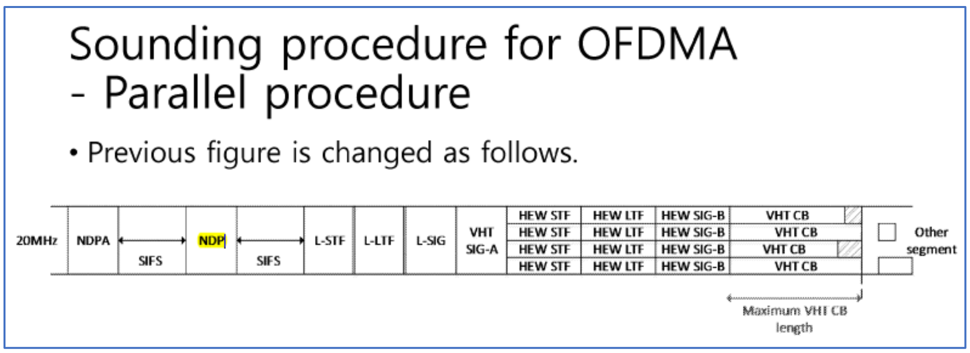
885. Limitation B of ’259 Claim 1 recites: “receiving a null data packet (NDP) frame from the transmitting device after receiving the NPDA frame.” Limitation B of ’259 Claim 18 is related and recites: “transmitting a null data packet (NDP) frame to the plurality of receiving devices after transmitting the NPDA frame.”

886. The ’270 provisional fully discloses transmitting an NDP from an access point to a station after the NDPA:

[redacted]



ATLAS-00008783.



ATLAS-00008789.

10.3.1 The '259 Provisional Fully Supports '259 Claim 1[C], 18[C]

887. Limitation C of '259 Claim 1 recites: "transmitting to the transmitting device a feedback frame including subchannel information measured on a first subchannel after receiving the NDP frame, the first subchannel being a subchannel that is allocated to the first receiving device among a plurality of subchannels into which a predetermined band is divided." Limitation C of '259 Claim 18 is related and recites: "receiving from each receiving device a feedback frame including subchannel information measured on a subchannel that is allocated to each receiving device among a plurality of subchannels into which a band is divided, after transmitting the NDP frame."

888. The '270 provisional fully discloses the beamformees (stations) can transmit feedback with subchannel information only measured on an allocated subchannel:

[redacted]

Sounding procedure for OFDMA
- Sequential procedure with sub-channel feedback

- But, some changes can makes more efficient sounding protocols for OFDMA
  - For OFDMA transmission, channel information for whole bandwidth is not necessary, beamformee STAs only need to response channel information for their allocated bandwidth.
  - Feedback information can be response by sequential (similar to VHT MU procedure in 11ac) or by parallel using OFDMA.
    - Because of decreasing feedback information, using parallel feedback may be possible.
  - But, in parallel response, different length of VHT CB frame may degrade MAC efficiency.

ATLAS-00008781.

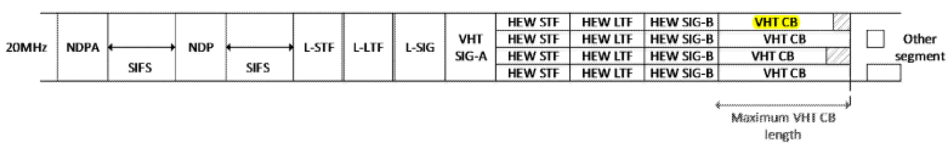
Sounding procedure for OFDMA
- Sequential procedure with sub-channel feedback

- In 11ac Standard, NDPA frame does not have any sub-channel information for feedback because channel feedback is always operated in whole bandwidth.
- NDPA frame has STA info field for each beamformee STA.
- Sub-channel information can be added this STA info field.
  - For example, in case of 5MHz sub-channel, 2bit represents position of feedback response for each beamformee STA.
- Beamformee STAs response only allocated sub-channel information, thus this can improve efficiency.

ATLAS-00008782.

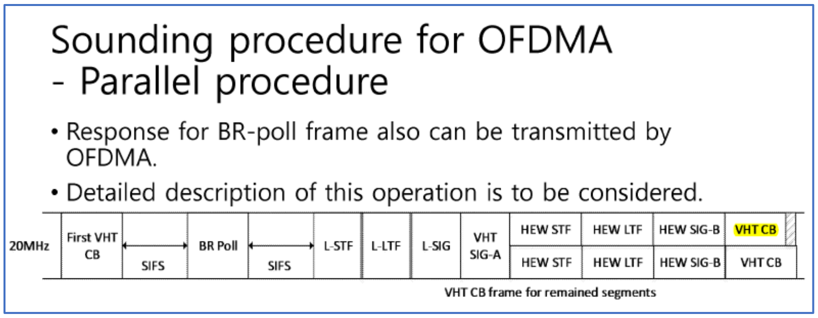
Sounding procedure for OFDMA
- Parallel procedure

- Previous figure is changed as follows.

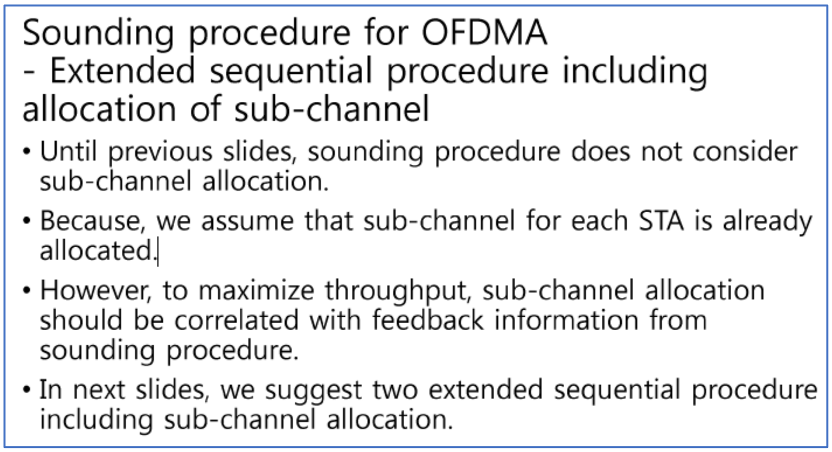


ATLAS-00008789.

[redacted]



ATLAS-00008792.



ATLAS-00008794.

10.3.1 The '259 Provisional Fully Supports '259 Claim 1[D], 18[D]

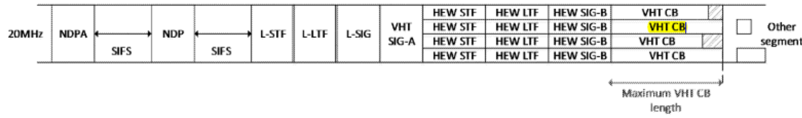
889. Limitation D of '259 Claim 1 recites: "wherein transmitting the feedback frame includes: transmitting the feedback frame to the transmitting device while a second feedback frame including subchannel information measured on the second subchannel is transmitted to the transmitting device by a second receiving device, the second subchannel being a subchannel that is allocated to the second receiving device among the plurality of subchannels." Limitation D of '259 Claim 18 is related and recites: "wherein the plurality of feedback frames from the plurality of receiving devices are received at a same time, and the NDPA frame includes allocation information of the plurality of subchannels."

890. As explained above, the '270 provisional fully supports station devices providing feedback on subchannels allocated to the station devices. The '270 provisional fully discloses station devices sending simultaneously feedback in parallel:

[redacted]

Sounding procedure for OFDMA
- Parallel procedure

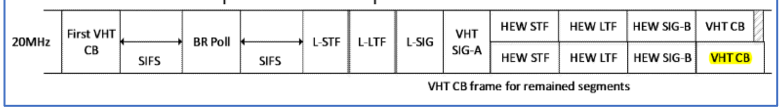
• Previous figure is changed as follows.



ATLAS-00008789.

Sounding procedure for OFDMA
- Parallel procedure

• Response for BR-poll frame also can be transmitted by OFDMA.
• Detailed description of this operation is to be considered.



ATLAS-00008792.

Sounding procedure for OFDMA
- Sequential procedure with sub-channel feedback

• In 11ac Standard, NDPA frame does not have any sub-channel information for feedback because channel feedback is always operated in whole bandwidth.
• NDPA frame has STA info field for each beamformee STA.
• Sub-channel information can be added this STA info field.
    • For example, in case of 5MHz sub-channel, 2bit represents position of feedback response for each beamformee STA.
• Beamformee STAs response only allocated sub-channel information, thus this can improve efficiency.

ATLAS-00008782.

Sounding procedure for OFDMA
- Extended sequential procedure including allocation of sub-channel

• Until previous slides, sounding procedure does not consider sub-channel allocation.
• Because, we assume that sub-channel for each STA is already allocated.
• However, to maximize throughput, sub-channel allocation should be correlated with feedback information from sounding procedure.
• In next slides, we suggest two extended sequential procedure including sub-channel allocation.

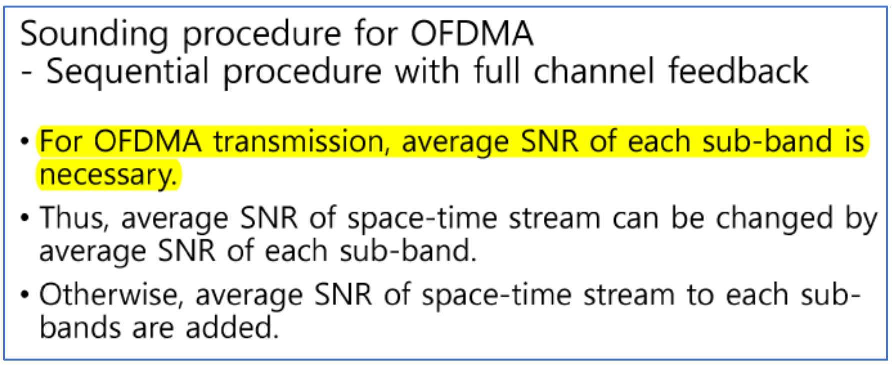
ATLAS-00008794.

[redacted]

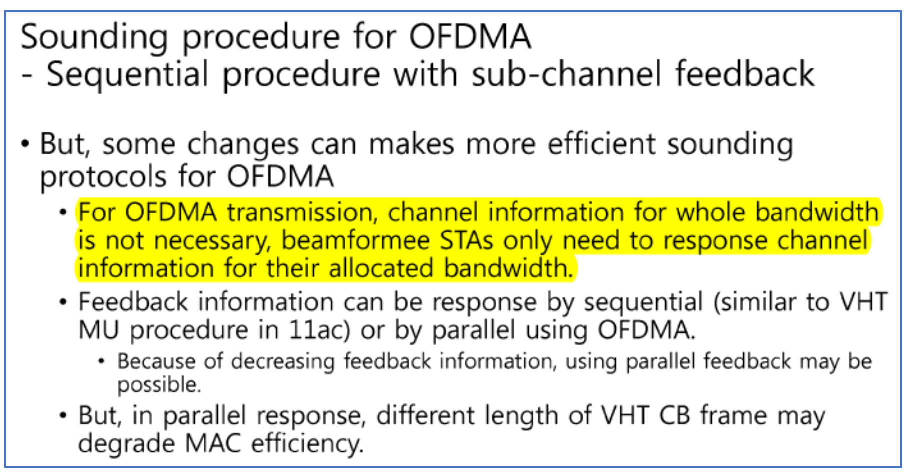
10.3.1 The '259 Provisional Fully Supports '259 Claim 2

891. '259 Claim 2 recites: "The method of claim 1, wherein the subchannel information includes an average signal-to-noise ratio (SNR) of the first subchannel."

892. The '270 provisional fully discloses that the subchannel information sent by the stations includes SNR of the allocated subchannel. Specifically, the '270 provisional explains that average SNR of each sub-band is necessary, but channel information for the whole bandwidth is unnecessary, so the station only need to respond with SNR of the assigned subchannel:



ATLAS-00008780.



ATLAS-00008781.

10.3.1 The '259 Provisional Fully Supports '259 Claim 3

893. '259 Claim 3 recites: "The method of claim 1, wherein the subchannel information includes average signal-to-noise ratios (SNRs) of the first subchannel for a plurality of space-time streams."

[redacted]

894. The ’270 provisional fully discloses the subchannel information sent by the stations includes SNR of the allocated subchannel among a plurality of subchannels. Specifically, the ’270 provisional explains that average SNR of each sub-band is necessary, but channel information for the whole bandwidth is unnecessary, so the station only need to respond with SNR of the assigned subchannel:

> Sounding procedure for OFDMA
> - Sequential procedure with full channel feedback
>
> - For OFDMA transmission, average SNR of each sub-band is necessary.
> - Thus, average SNR of space-time stream can be changed by average SNR of each sub-band.
> - Otherwise, average SNR of space-time stream to each sub-bands are added.

ATLAS-00008780.

> Sounding procedure for OFDMA
> - Sequential procedure with sub-channel feedback
>
> - But, some changes can makes more efficient sounding protocols for OFDMA
>   - For OFDMA transmission, channel information for whole bandwidth is not necessary, beamformee STAs only need to response channel information for their allocated bandwidth.
>   - Feedback information can be response by sequential (similar to VHT MU procedure in 11ac) or by parallel using OFDMA.
>   - Because of decreasing feedback information, using parallel feedback may be possible.
>   - But, in parallel response, different length of VHT CB frame may degrade MAC efficiency.

ATLAS-00008781.

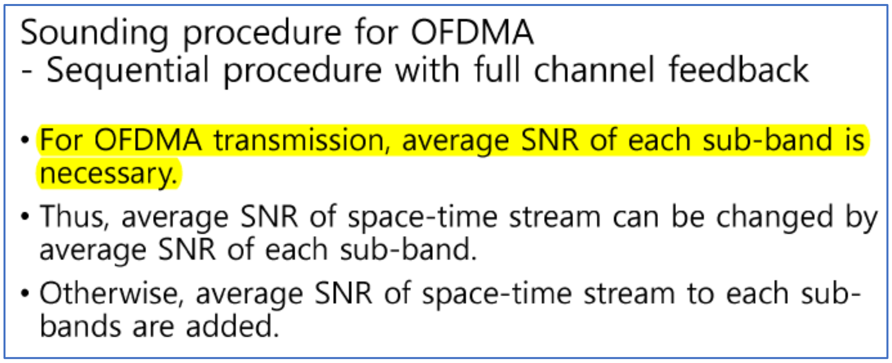
10.3.1 The ’259 Provisional Fully Supports ’259 Claim 4

895. ’259 Claim 4 recites: “The method of claim 1, wherein the feedback frame further includes subchannel information measured on other subchannels excluding the first subchannel.”

896. The ’270 provisional fully discloses including subchannel information measured on other subchannels excluding the first subchannel be explaining that feedback can include SNR information for all subchannels. Specifically, the ’270 provisional explains

[redacted]

that average SNR of each sub-band is necessary, but channel information for the whole bandwidth is unnecessary, so the station only need to respond with SNR of the assigned subchannel:

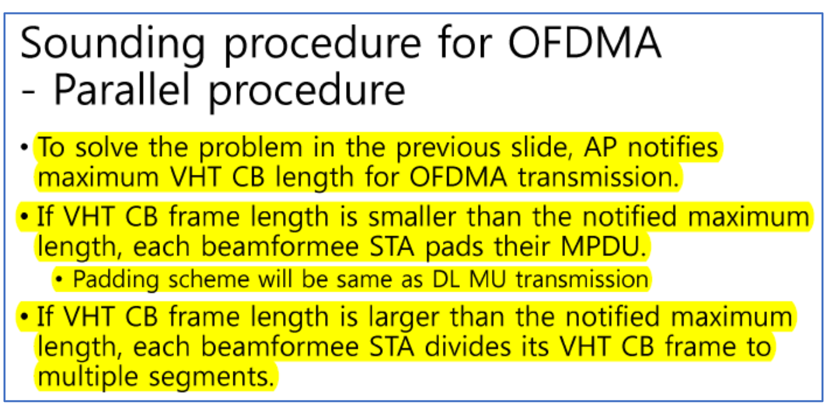


ATLAS-00008780.

10.3.1 The ’259 Provisional Fully Supports ’259 Claim 5

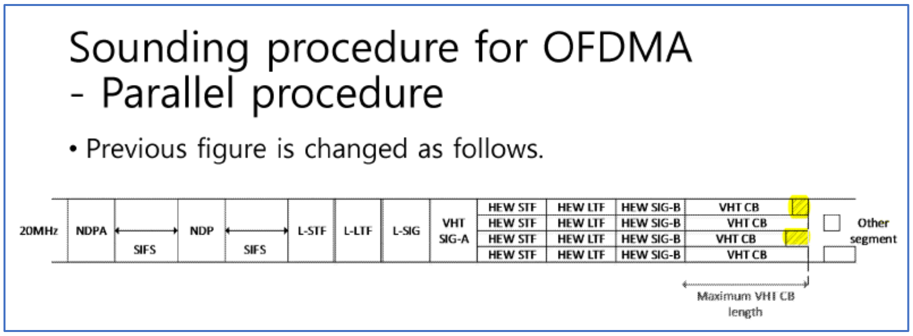
897. ’259 Claim 5 recites: “The method of claim 1, wherein transmitting the feedback frame includes adding pad bits to a data field of the feedback frame when a length of data to be transmitted by the feedback frame is shorter than a predetermined length, or partitioning the data into a plurality of fragments and inserting any one of the fragments to the data field of the feedback frame when the length of the data is longer than the predetermined length.”

898. The ’270 provisional fully discloses padding the feedback frame when it is shorter than a predetermined length or segmenting it when it is longer than the predetermined length:



ATLAS-00008788.

[redacted]

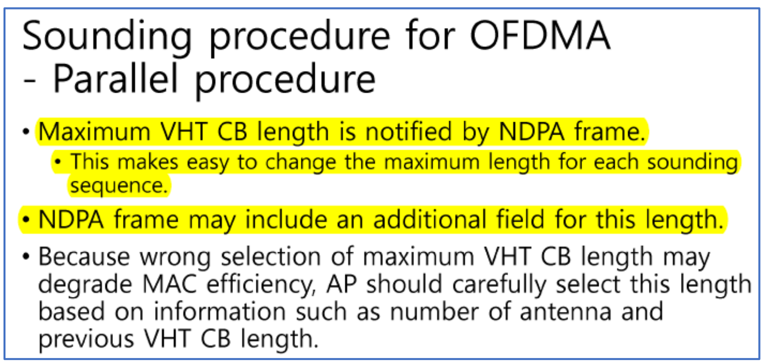


ATLAS-00008789.

10.3.1 The ’259 Provisional Fully Supports ’259 Claim 6

899. ’259 Claim 6 recites: “The method of claim 5, wherein the NDPA frame indicates information corresponding to the predetermined length.”

900. The ’270 provisional fully discloses including information related to the length of the feedback frame in the NDPA:



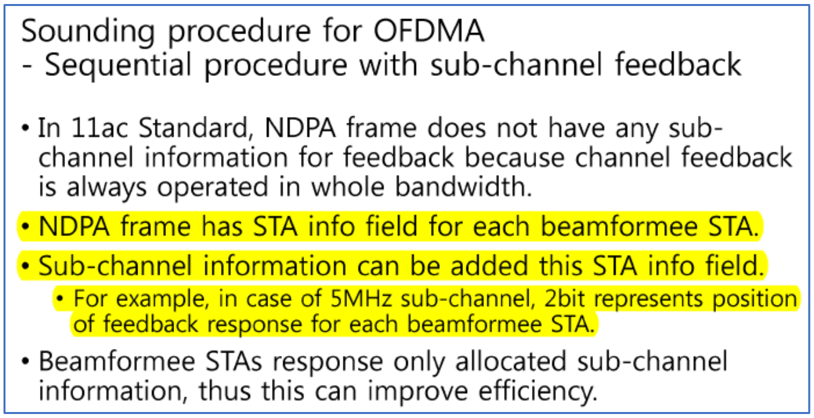
ATLAS-00008790.

10.3.1 The ’259 Provisional Fully Supports ’259 Claim 7

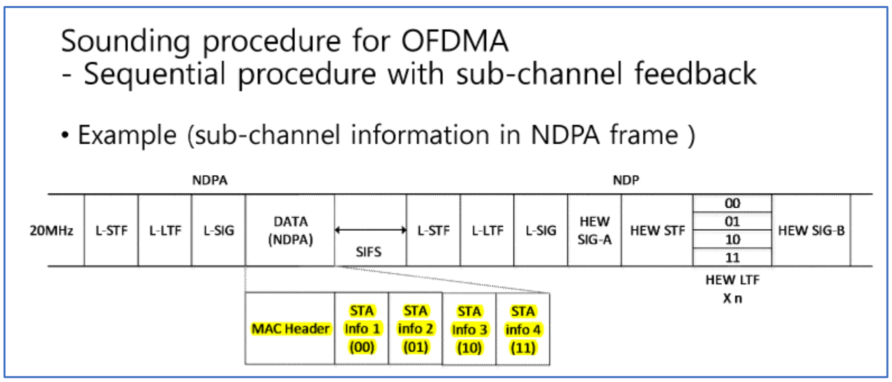
901. ’259 Claim 7 recites: “The method of claim 1, wherein the NDPA frame includes allocation information of the first subchannel.”

902. The ’270 provisional fully discloses including subchannel allocation information of the subchannel allocated to the first station:

[redacted]



ATLAS-00008782.



ATLAS-00008783.

903. Based at least on the foregoing citations and figures, it is my opinion that the '259 claims are supported by the provisional application.

904. Dr. Hansen provides an analysis of the '259 priority claims, which I mostly agree with. Hansen Report at ¶53. I particularly agree with Dr. Hansen that the '259 claimed inventions were "constructively reduce[d] … to practice by filing U.S. Provisional Application No. 62/054,270 on September 23, 2014." *Id.*

10.4 Claim Construction

905. The Court issued a claim construction order on February 8, 2023 ("Claim Construction Order" or "Markman Order"). Dkt. No. 117. I have applied the constructions therein. For terms the court did not construe, I have applied the plain and ordinary meaning to a person of ordinary skill in the art at the time of invention.

906. With respect to the '259 patent, the Court construed the following term:

Term or phrase	Court's Construction

[redacted]

"wherein the NDPA frame indicates information corresponding to the predetermined length	Plain meaning

Dkt. No. 117 at 24.

907. In its analysis, the Court cited the '259 Patent at 15:38-65, 2:35–37 and Figure 20, and noted that Defendants' arguments "do not demonstrate any lack of reasonable clarity of the claim language." Dkt. No. 117 at 23. The Court also noted that "*Sercomm/ASUS* also rejected substantially the same indefiniteness argument presented here by Defendants, noting that 'a claim term is not indefinite simply because it is broad.'" *Id.* (citing Dkt. No. 90-1 (*Sercomm/ASUS* claim construction order) at 25). Thus, the Court rejected Defendants' indefiniteness positions.

10.5 Overview of Dr. Hansen's Alleged '259 Prior Art

908. Dr. Hansen analyzes five references in connection with the '259 Patent: (1) U.S. Patent Publication 2017/0033898 to Jinyoung Chun et al ("Chun," Hansen Ex. 259-2), U.S. Patent Publication 2014/0204891 to Jong Hyun Park et al ("Park," Hansen Ex. 259-3), U.S. Patent Publication 2013/00223427 to Ill Soo Sohn et al ("Sohn," Hansen Ex. 259-4), U.S. Patent Publication 2012/0250543 to Santosh Paul Abraham et al ("Abraham," Hansen Ex. 259-5) , and U.S. Patent Publication 2013/0286959 to Hanqing Lou ("Lou," Hansen Ex. 259-6). Hansen Report at ¶¶1563-1865. I provide an overview of each below.

10.5.1 Chun

909. Chun is titled "Method and Apparatus for transmitting Frame of Basis of Sounding Procedure." Chun at Title Page. Chun generally relates to methods for transmitting frames based on a sounding feedback procedure. *Id.* It describes a sounding method comprising: "transmitting by an access point (AP) a null data packet announcement (NDPA) frame to each of a plurality of stations (STAs), wherein the NDPA frame reports transmission of a null data packet (NDP); transmitting by the AP the NDP to each of the plurality of STAs; receiving by the AP a plurality of feedback frames to be transmitted respectively through a plurality of transmission resources allocated respectively to the plurality of STAs on an

[redacted]

overlapping time resource respectively by the plurality of STAs; and transmitting by the AP a plurality of downlink frames respectively to the plurality of STAs." Chun at [0008].

910. Chun generally describes several sounding procedures between and access point and one or more station devices. Dr. Hansen relies primarily on three methods described in Chun: a single user feedback method illustrated by Figure 4, a multi user feedback method illustrated by Figure 8, and a sequential feedback method illustrated by Figure 10:

FIG. 4

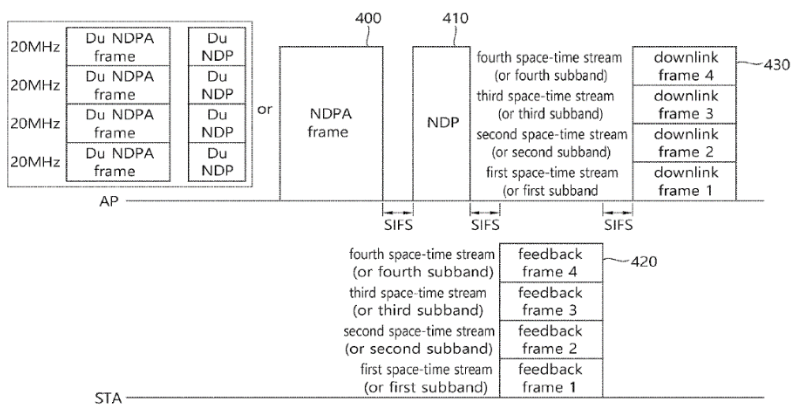
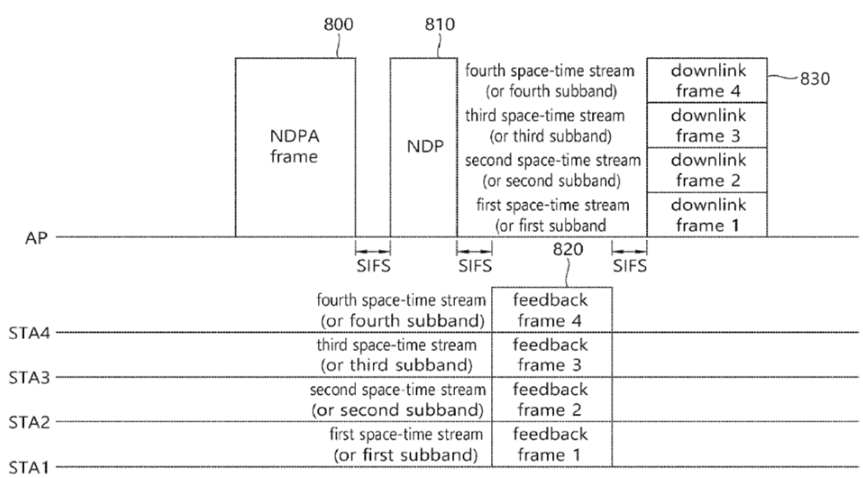
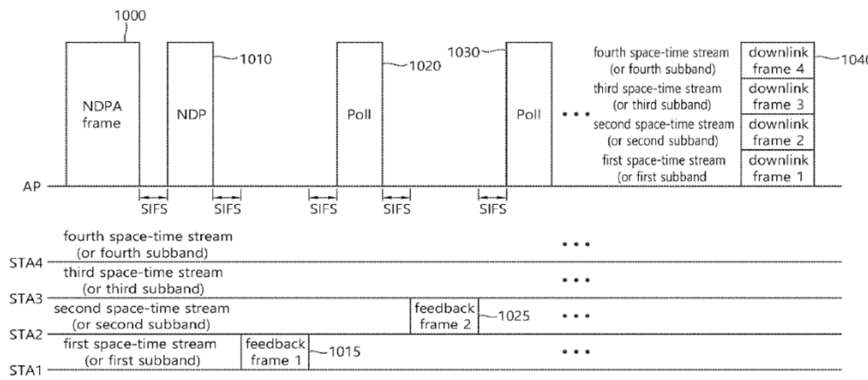


FIG. 8



[redacted]

FIG. 10



911. Chun Figs 4, 8, 10. Each of these figures illustrates a method of obtaining channel state information across a number of space-time streams. Importantly, and unlike the ’259 Patent, Chun does not disclose padding or partitioning frames based on a predetermined length. Chun also does not describe including information about the predetermined length in the NDPA. Dr. Hansen has not proven that Chun is prior art to the ’259 Patent. Chun was filed on October 7, 2016 (which is more than two years after the ’259 Patent’s September 22, 2015 priority effective date). But Chun claims priority to two provisional applications, filed on April 9, 2014 and June 20, 2014 and a Korean PCT Application filed on February 16, 2015. Thus, Chun is only prior art under post-AIA §102(a) if Dr. Hansen proves that the disclosures from Chun that he relies upon are fully supported by either of Chun’s April 9, 2014 provisional application or Chun’s June 20, 2014 provisional application. Yet Dr. Hansen never performs this analysis. Accordingly, Dr. Hansen has not met his burden to prove that Chun is prior art to the ‘259 Patent.

10.5.2 Park

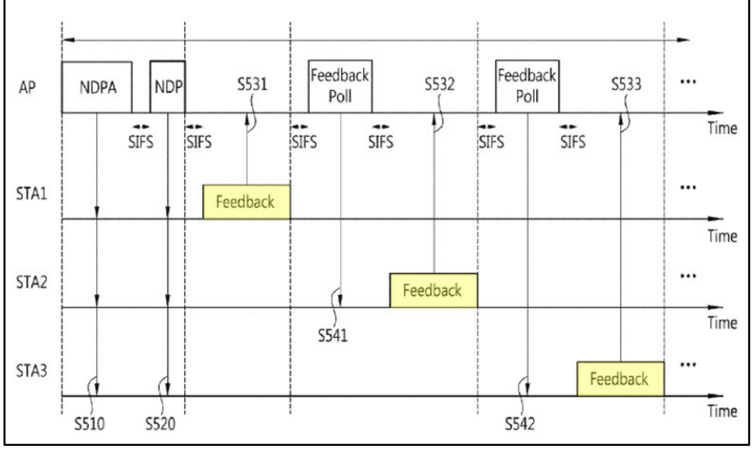
912. Park is titled “Method and Apparatus for Transmitting and Receiving Frame on the Basis of Frequency Selection Transmission.” Park at Title Page. Park generally relates to a method “for transmitting and receiving frames on the basis of [a] frequency selection transmission in a wireless local area network (WLAN) system.” Park at [0006]. It explains

[redacted]

that the method involves "acquiring first channel state information regarding each of the plurality of sub-channels from a first receiver, [and] allocating one or more first allocation sub-channels, among the plurality of sub-channels, to the first receiver on the basis of the first channel state information." Park at [0007]. When a second receiver is involved, the method includes "acquiring second channel state information regarding each of the plurality of sub-channels from a second receiver, allocating one or more second allocation sub-channels, among the plurality of sub-channels, to the second receiver on the basis of the second channel state information." *Id.* A data unit is then transmitted to the receivers via the allocated sub channels. *Id.*

913. Park describes a feedback method where multiple stations transmit feedback in sequential single user transmissions:

FIG. 5



Park at Fig. 5. Importantly, and unlike the '259 Patent, Park never describes simultaneous multi user feedback.

10.5.3 Sohn

914. Sohn is titled "Channel Sounding Method in Wireless Local Area Network System and Apparatus for Supporting the Same." Sohn characterizes itself as providing a "method for a channel sounding in a wireless local area network is provided. The method includes

[redacted]

transmitting a null data packet announcement (NDPA) frame, to a plurality of receivers, the NDPA frame requesting a channel statement information feedback and announcing that a null data packet (NDP) frame is to be transmitted; transmitting the NDP frame being a basis of channel estimation for the plurality of receivers; receiving a first feedback frame from a first receiver among the plurality of receivers, transmitting a feedback poll frame to a second receiver; and, receiving a second feedback frame from the second receiver, the second feedback frame including second channel state information estimated by the second receiver. If the first receiver fails to perform the channel estimation, the first feedback frame is a null feedback frame. The null feedback frame is a feedback frame not including channel state information." *Id.* at Abstract.

915. Sohn fails to disclose several important elements of the '259 Patent's claims, as I explain in more detail below.

10.5.4 Abraham

916. Abraham is titled "Systems and Methods of Communication of Channel State Information." Abraham characterizes itself as relating to "technique for communicating Channel State Information (CSI) feedback. In some aspects, the CSI feedback is communicated in a very high throughput (VHT) wireless communications system." *Id.* at Abstract. Figure 1 illustrates "a diagram of a wireless communications network in accordance with certain aspects of the present disclosure."

[redacted]

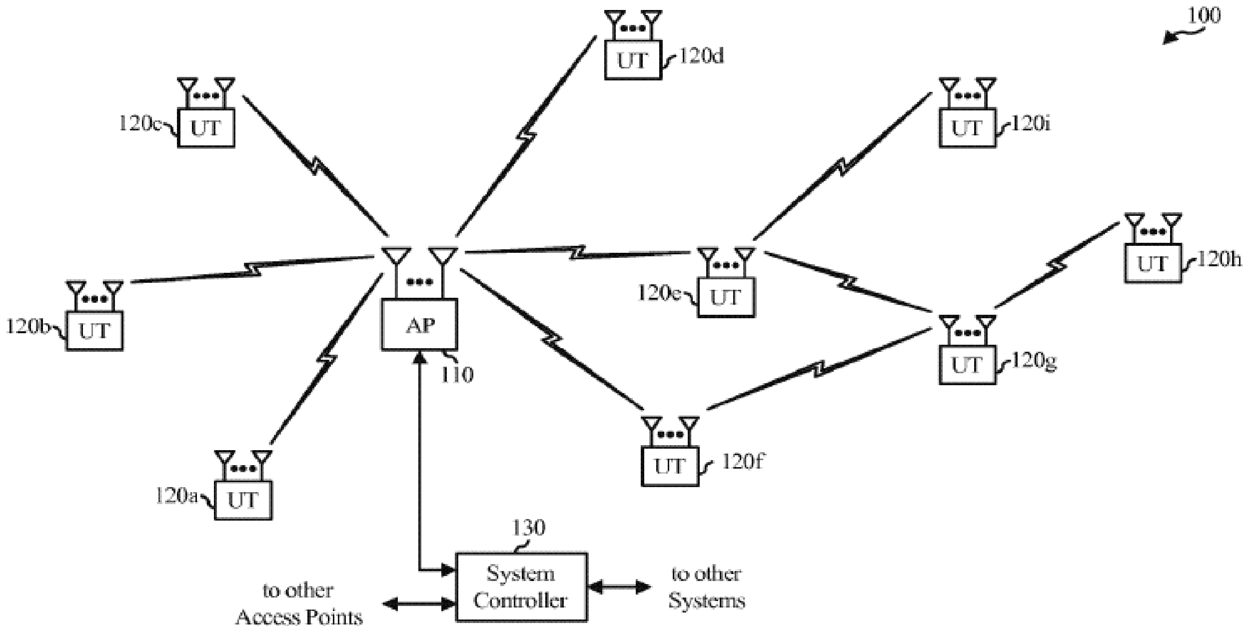


FIG. 1

917. Abraham fails to disclose several important elements of the ’259 Patent’s claims, as I explain in more detail below.

10.5.5 Lou

918. Lou is titled “Method and Apparatus for Supporting Coordinated Orthogonal Block-Based Resource Allocation (COBRA) Operations.” Lou characterizes itself as disclosing a “method and apparatus may be configured to support coordinated orthogonal block-based resource allocation (COBRA) operations. An access point (AP) may be configured to indicate to a plurality of stations (STA)s that it may support COBRA. Each WTRU may be configured to indicate to the AP that it can support COBRA as well. The AP may be configured to transmit a COBRA controller information element (IE) comprising a plurality of fields to each of the WTRUs. Each WTRU may be configured to transmit a COBRA controllee IE comprising a plurality of fields. STA grouping management, group maintenance, channel access, beamforming, sounding and frequency and synchronization procedures are also described.” *Id.* at Abstract.

[redacted]

919. Lou fails to disclose several important elements of the '259 Patent's claims, as I explain in more detail below.

10.6 Dr. Hansen's Alleged Prior Art Does Not Invalidate the Asserted '259 Claims

920. Dr. Hansen states that each of the following references anticipate the Asserted '259 claims: Chun, Park, Sohn, Abraham, and Lou. Hansen Report at ¶1564. Dr. Hansen also states that those same references render the Asserted '259 claims obvious, either by themselves or in any combination of those five references. *Id.* I disagree.

10.6.1 Chun Is Not Prior Art and Fails To Disclose Or Render Obvious Several '259 Claim Limitations

10.6.1.1 Chun is Not Prior Art

921. As explained above in §10.4.1 overview of Chun, Dr. Hansen has not proven that Chun is prior art to the '259 Patent. Accordingly, Dr. Hansen cannot show that all the claim limitations are taught or suggested by Chun, and Dr. Hansen's '259 invalidity analysis based on Chun necessarily fails.

10.6.1.2 Chun Does Not Disclose or Render Obvious "adding pad bits to a data field of the feedback frame when a length of data to be transmitted by the feedback frame is shorter than a predetermined length, or partitioning the data into a plurality of fragments and inserting any one of the fragments to the data field of the feedback frame when the length of the data is longer than the predetermined length." (5)

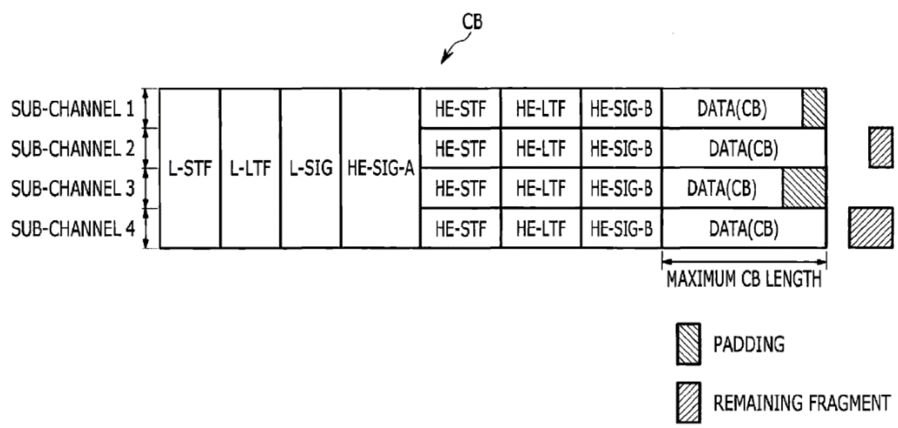
922. Claim 5 of the '259 Patent requires the elements of claim 1 and "adding pad bits to a data field of the feedback frame when a length of data to be transmitted by the feedback frame is shorter than a predetermined length, or partitioning the data into a plurality of fragments and inserting any one of the fragments to the data field of the feedback frame when the length of the data is longer than the predetermined length." '259 at 22:65-67 ('259 cl. 5).

923. Dr. Hansen cites evidence that he asserts proves Chun discloses this limitation. Hansen Report at ¶¶1707-1710. But Chun does not teach or suggest this limitation, as described below.

[redacted]

924. The ’259 Patent illustrates frame padding and fragmentation in figure 15:

FIG. 15



‘259 Fig. 15. As the ’259 Patent explains, when practicing multiuser feedback, the lengths of the feedback frames (CB) may be different between the stations. ’259 at 15:8-10. “When receiving the CB frames having different lengths in parallel, the beamformer device may not decode the received CB frames. Because the length of the data field in the CB frame is determined by each beamformee device, each beamformee device cannot know the length of the data field to be transmitted by the other beamformee device such that padding for adjusting the length of the data field cannot be performed.” *Id.* at 11-18.

925. To resolve this problem, the ’259 Patent explains that this problem can be avoided by setting the feedback frame to a maximum length, and padding or fragmenting the feedback to meet that length:

> [E]ach beamformee device may transmit a CB frame by adjusting a length of the CB frame to a maximum CB length. Therefore, when the length of data to be transmitted through the data field of the CB frame is shorter than the maximum CB length, the beamformee device may perform the padding for adding pad bits to remaining portion of the data field. When the length of data to be transmitted through the data field of the CB frame is longer than the maximum CB length, the beamformee device may partition the beamforming report information into two or more :fragments and transmit two or more CB frames.

’259 at 15:19-30.

[redacted]

926. Chun never teaches feedback frame padding or fragmenting—certainly not at any of the passages cited by Dr. Hansen. Hansen Report at ¶¶1707-1710. Dr. Hansen does not attempt to point to any frame padding or fragmenting.

927. For these reasons, it is my opinion that Park does not teach or suggest this limitation.

10.6.1.3 Chun Does Not Disclose or Render Obvious that "the NDPA frame indicates information corresponding to the predetermined length." (6).

928. Claim 6 of the '259 Patent requires the elements of claim 5 and that "the NDPA frame indicates information corresponding to the predetermined length." '259 at 23:1-4 ('259 cl. 6).

929. Dr. Hansen cites evidence that he asserts proves Chun discloses this limitation. Hansen Report at ¶¶1725-1726. But Chun does not teach or suggest this limitation, as described below.

930. As I explained above, the '259 Patent discloses padding and fragmenting frames to ensure that each of the multiuser feedback frames are identical in length. As I explained above, Chun does not disclose this. Moreover, the '259 Patent explains that the maximum length can be indicated by a beamformer using an NDPA frame:

> In some embodiments, the beamformer device may indicate the maximum CB length to the beamformee devices. The maximum CB length may be a maximum length of the data field in the CB frame or a maximum length of the CB frame.
>
> In one embodiment, the beamformer device may indicate the maximum CB length using the NDPA frame. For example, a data field of the NDPA frame, i.e., a frame body field of a MAC frame inserted to the NDPA frame may include information on the maximum CB length.

'259 at 15: 38-47.

931. Chun never teaches indicating the maximum length of the feedback frame in the NDPA. Dr. Hansen points to Chun's discussion of the TXOP. Hansen Report ¶ 1725. However, as Chun explains, TXOP is a time threshold over which a frame may be transmitted rather than a set length as described by the '259 Patent. Chun at [0058]. And

[redacted]

even if TXOP were a equivalent to a predetermined length, Dr. Hansen has not identified anything in Chun that suggests that the TXOP is indicated by the NDPA.

932. For these reasons, it is my opinion that Park does not teach or suggest this limitation.

10.6.2 Park Fails To Disclose Or Render Obvious Several '259 Claim Limitations

10.6.2.1 Park Fails to Teach or Suggest a "wherein transmitting the feedback frame includes: transmitting the feedback frame to the transmitting device while a second feedback frame including subchannel information measured on the second subchannel is transmitted to the transmitting device by a second receiving device, the second subchannel being a subchannel that is allocated to the second receiving device among the plurality of subchannels" (1D)

933. Independent claim 1 of the '259 Patent requires "wherein transmitting the feedback frame includes: transmitting the feedback frame to the transmitting device while a second feedback frame including subchannel information measured on the second subchannel is transmitted to the transmitting device by a second receiving device, the second subchannel being a subchannel that is allocated to the second receiving device among the plurality of subchannels." '259 at 22:46-53 ('259 cl. 1).

934. Dr. Hansen cites evidence that he asserts proves Park discloses this limitation. Hansen Report at ¶¶1645-1647 (1[d]). But Park does not teach or suggest this limitation, as described below.

935. Dr. Hansen cites various passages from Park that characterize an STA transmitting a feedback frame to an AP in response to receiving an NDP from the AP. Hansen Report ¶1645 (citing Park at [0163]) ("When NDP transmission is finished … the STA1, which has been determined to respond first with respect to the NDP, transmits a feedback frame…."). However, none of the Park passages cited by Dr. Hansen teach that the feedback frame is transmitted "while a second feedback frame including subchannel information measured on the second subchannel is transmitted to the transmitting device

[redacted]

by a second receiving device." Park's feedback frame is not transmitted in a multi-user mode.

936. The '259 Patent uses Figures 20, 22, and 24 to illustrate how the feedback frame is sent by a first STA while a second feedback frame is sent by a second STA. In those embodiments, the beamformer (or AP) transmits a Null Data Packet Announcement ("NDPA") frame (colored green in the below figure) to each of beamformee (or STA) 1-4. That NDPA is followed by a Null Data Packet ("NDP") frame (colored blue in the below figure), also sent to each of beamformee 1-4. In response, compressed beamforming frames (colored yellow in the below figure) are sent by the beamformees 1-4 to the beamformer. In each of these embodiments, the compressed beamforming frames are transmitted by the beamformees in parallel, that is, simultaneously:

FIG. 20

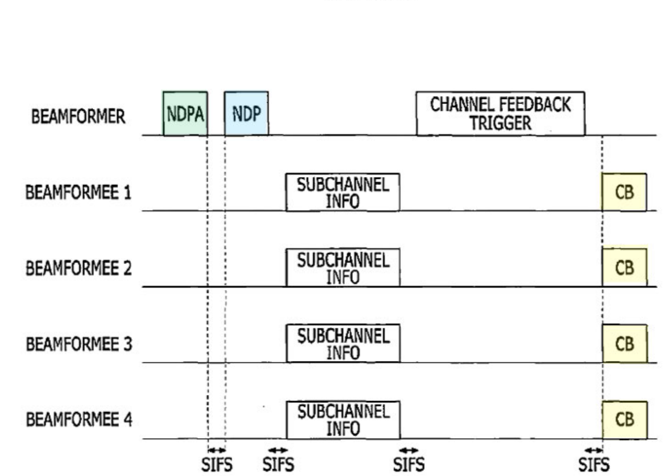
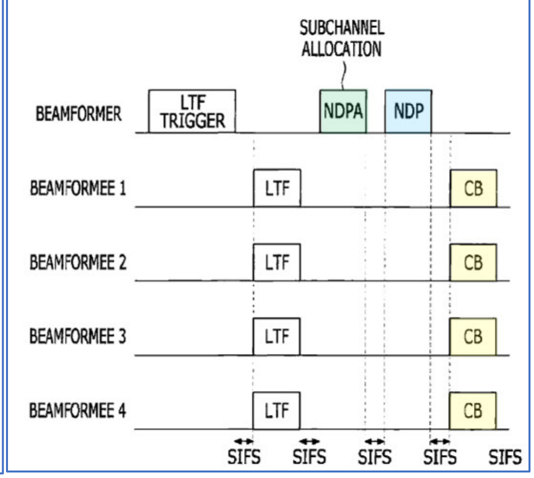
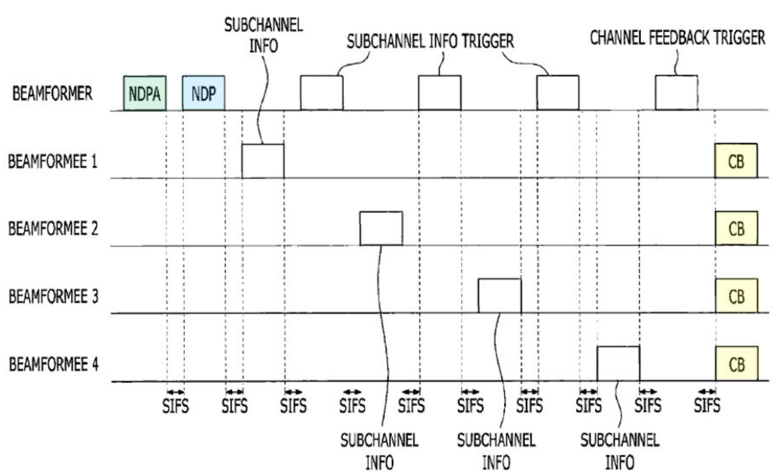


FIG. 24



[redacted]

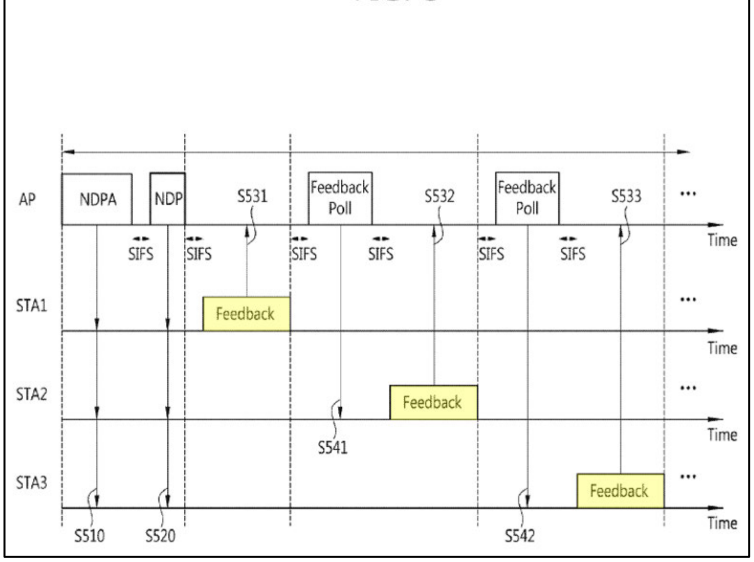
FIG. 22



’259 Figs. 20, 22, and 24 (annotations and highlighting added).

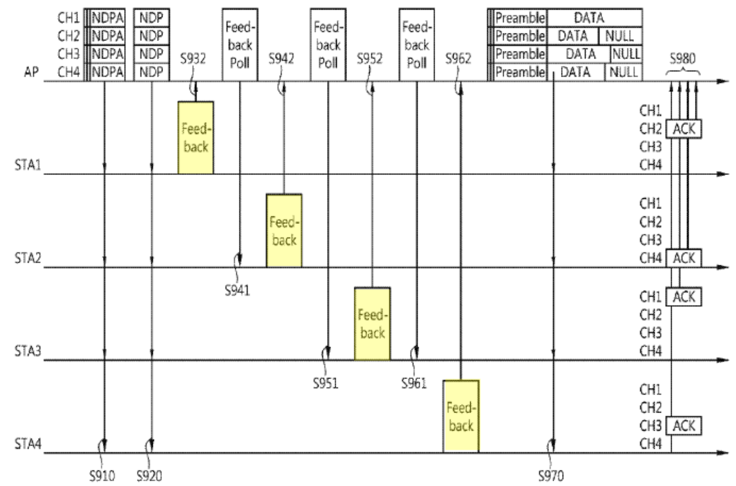
937. Park never has a commensurate disclosure as the ’259 Patent. Instead, Park’s teaching regarding sounding feedback expressly contemplate MU feedback. For example, both figures illustrating Park’s feedback method (Figs. 5 and 9) expressly show single-user, sequential feedback:

FIG. 5



[redacted]

FIG. 9



Park Figs. 5 & 9 (annotated). Park explains that in this sequential process, the AP polls additional STAs after STA1 when it determines to allocate sub-channels to a plurality of STAs:

> In a case in which the AP determines to transmit a data frame by using a particular sub-channel among the CH1 to CH4, the AP may perform polling through feedback poll frame transmission. **<u>The AP transmits a feedback poll frame requesting transmission of a feedback frame including channel state information to the STA2 (S941). The STA2 transmits a feedback frame to the AP in response to the feedback poll frame (S942).</u>**
>
> When the AP determines to allocate all of sub-channels, excluding a sub-channel which has been allocated to the STA1, to the STA2 to transmit a data frame, the AP may terminate polling. However, in a case in which the AP determines to allocate some sub-channels to transmit a data frame, **<u>the AP transmits a feedback poll frame requesting transmission of a feedback frame including channel state information to the STA3 (S951).</u>** **<u>The STA[3] transmits a feedback frame to the AP in response to the feedback poll frame (S952).</u>**
>
> In a case in which the AP determines to allocate all of the sub-channels, excluding sub-channels allocated to the STA1 and STA2, to transmit a data frame, the AP may terminate polling. Meanwhile, in a case in which the AP determines to allocate some sub-channels to transmit a data frame, **<u>the AP transmits a feedback poll frame requesting transmission of a feedback frame including channel state information to the STA4 (S961). The STA4 transmits a feedback frame to the AP in response to the feedback poll frame (S962)</u>**.

Park [0166-0168].

[redacted]

938. Park never teaches multi-user channel sounding feedback—certainly not at any of the passages cited by Dr. Hansen. Hansen Report at ¶¶1645-1647. Dr. Hansen does not attempt to point to any multi-user feedback in Park.

939. For these reasons, it is my opinion that Park does not teach or suggest this limitation.

10.6.2.2 Park Fails to Teach or Suggest a "wherein the plurality of feedback frames from the plurality of receiving devices are received at a same time, and the NDPA frame includes allocation information of the plurality of subchannels." (18D)

940. Independent claim 18 of the '259 Patent requires "wherein the plurality of feedback frames from the plurality of receiving devices are received at a same time, and the NDPA frame includes allocation information of the plurality of subchannels." '259 at 24:44-46 ('259 cl. 18).

941. Dr. Hansen cites evidence that he asserts proves Park discloses this limitation. Hansen report at ¶¶1839-1841 (1[d]). But Park does not teach or suggest this limitation, as described below.

942. Dr. Hansen cites two passages from Park that characterize allocating subchannels to one or more receivers based on channel state information. Hansen Report ¶¶1839-1840 (citing Park at [0011] ("The step of allocating the one or more first allocation sub-channels to the first receiver…."), [0021] ("The processor is configured to … allocate one or more first allocation sub-channels, among the plurality of subchannels, to the first receiver on the basis of the first channel state information, … [and] allocate one or more second allocation sub-channels to the second receiver on the basis of the second channel state information….") However, none of the Park passages cited by Dr. Hansen teach that the feedback frame is transmitted "wherein the plurality of feedback frames from the plurality of receiving devices are received at a same time." Park's feedback frame is not transmitted in a multi-user mode.

[redacted]

943. As I explained above with respect to element 1D and incorporate here, the ’259 illustrates how channel sounding feedback is sent simultaneously by multiple STAs to an AP. On the other hand, Park has no commensurate disclosure, as I explained above.

944. Park never teaches multi-user channel sounding feedback—certainly not at any of the passages cited by Dr. Hansen. Hansen Report at ¶¶1839-1841. Dr. Hansen does not attempt to point to any multi-user feedback in Park.

945. For these reasons, it is my opinion that Park does not teach or suggest this limitation.

10.6.3 Sohn Fails To Disclose Or Render Obvious Several ‘259 Claim Limitations

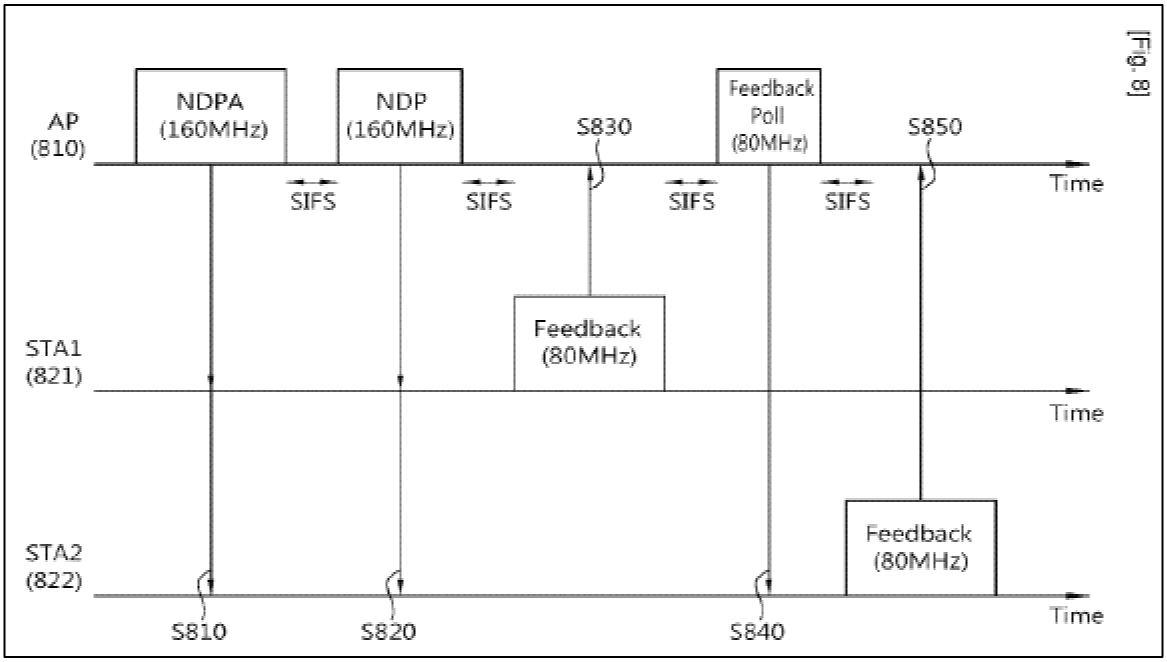
10.6.3.1 Sohn Fails to Teach or Suggest a “wherein transmitting the feedback frame includes: transmitting the feedback frame to the transmitting device while a second feedback frame including subchannel information measured on the second subchannel is transmitted to the transmitting device by a second receiving device, the second subchannel being a subchannel that is allocated to the second receiving device among the plurality of subchannels” (1D)

946. Independent claim 1 of the ’259 Patent requires “wherein transmitting the feedback frame includes: transmitting the feedback frame to the transmitting device while a second feedback frame including subchannel information measured on the second subchannel is transmitted to the transmitting device by a second receiving device, the second subchannel being a subchannel that is allocated to the second receiving device among the plurality of subchannels”. ’259 at 22:46-53 (’259 cl. 1).

947. Dr. Hansen cites evidence that he asserts proves Sohn discloses this limitation. Hansen Report at ¶¶1648. But Sohn does not teach or suggest this limitation as described below.

948. Dr. Hansen relies on Figure 8 and its accompanying discussion as proof that Sohn discloses this limitation. Hansen Report at ¶1648 (citing Sohn at [0125], [0126], Fig. 8. Figure 8 of Sohn illustrates a sounding method between two stations and an access point:

[redacted]



Sohn Fig. 8.

949. As I explained above with respect to Park and incorporate here, the ’259 Patent and 802.11ax specification both contemplate simultaneous multi-user channel sounding feedback. However, unlike 802.11ax and the ’259 Patent, Sohn’s feedback method only contemplates single user feedback, rather than multiuser feedback by multiple stations simultaneously. *Id.* As Sohn explains, first, “The STA.1810 performs channel estimation … and feeds channel state information about the 80 MHz bandwidth back to the AP 810 at step S830.” Sohn at [0124]Then, “[i]n order to receive channel state information from the ST.A2822, the **<u>AP 810 transmits a feedback poll frame to the STA2822 at step S840</u>**.” Sohn at [0125]. Accordingly, Sohn only contemplates single-user feedback.

950. Sohn never teaches multi-user channel sounding feedback—certainly not at any of the passages cited by Dr. Hansen. Hansen Report at ¶¶1648-1649. Dr. Hansen does not attempt to point to any multi-user feedback in Sohn.

951. For these reasons, it is my opinion that Sohn does not teach or suggest this limitation.

[redacted]

10.6.3.2 Sohn Fails to Teach or Suggest a "wherein the plurality of feedback frames from the plurality of receiving devices are received at a same time, and the NDPA frame includes allocation information of the plurality of subchannels." (18D)

952. Independent claim 18 of the '259 Patent requires "wherein the plurality of feedback frames from the plurality of receiving devices are received at a same time, and the NDPA frame includes allocation information of the plurality of subchannels." '259 at 24:44-46 ('259 cl. 18).

953. Dr. Hansen cites evidence that he asserts proves Sohn discloses this limitation. Hansen Report at ¶¶1842-1844 (1[d]). But Sohn does not teach or suggest this limitation, as described below.

954. Dr. Hansen cites two passages from Sohn that describe control information contained in an NDP frame, and transmission techniques for an NDPA frame. Hansen Report at ¶¶1842-1843 (citing Sohn at [0087], [0112]). However, none of the Sohn passages cited by Dr. Hansen teach that the feedback frame is transmitted "wherein the plurality of feedback frames from the plurality of receiving devices are received at a same time." Sohn's feedback frame is not transmitted in a multi-user mode.

955. As I explained above with respect to element 1D and incorporate here, the '259 illustrates how channel sounding feedback is sent simultaneously by multiple STAs to an AP. On the other hand, Sohn has no commensurate disclosure, as I explained above.

956. Sohn never teaches multi-user channel sounding feedback—certainly not at any of the passages cited by Dr. Hansen. Hansen Report at ¶¶1842-1844. Dr. Hansen does not attempt to point to any multi-user feedback in Sohn.

957. For these reasons, it is my opinion that Sohn does not teach or suggest this limitation.

[redacted]

10.6.4 Abraham Fails To Disclose Or Render Obvious Several '259 Claim Limitations

10.6.4.1 Abraham Fails to Teach or Suggest a "wherein transmitting the feedback frame includes: transmitting the feedback frame to the transmitting device while a second feedback frame including subchannel information measured on the second subchannel is transmitted to the transmitting device by a second receiving device, the second subchannel being a subchannel that is allocated to the second receiving device among the plurality of subchannels" (1D)

958. Independent claim 1 of the '259 Patent requires "wherein transmitting the feedback frame includes: transmitting the feedback frame to the transmitting device while a second feedback frame including subchannel information measured on the second subchannel is transmitted to the transmitting device by a second receiving device, the second subchannel being a subchannel that is allocated to the second receiving device among the plurality of subchannels." '259 at 22:46-53 ('259 cl. 1).

959. Dr. Hansen cites evidence that he asserts proves Abraham discloses this limitation. Hansen report at ¶¶1605-1654. But, Abraham does not teach or suggest this limitation as described below.

960. Dr. Hansen relies primarily on Abraham's discussion of a channel sounding method. Hansen Report at ¶1650-1653 (citing Abraham at Fig. 4, [0022], [0061], [0070], [0071], [0073]). Figure 4 illustrates this method, where feedback is sent sequentially from one or more stations to an access point:

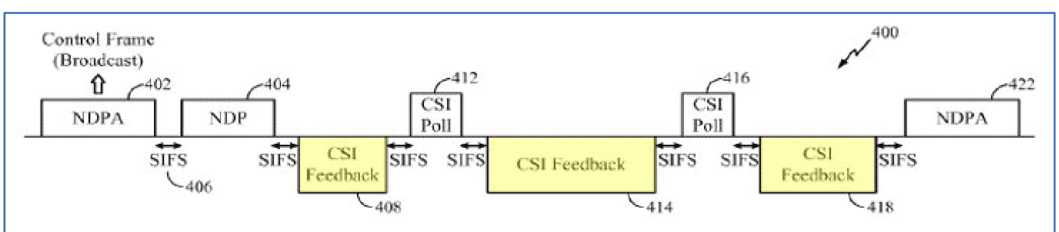


FIG. 4

Fig. 4 (annotated).

961. As I explained above with respect to Park and incorporate here, the '259 Patent and 802.11ax specification both contemplate simultaneous multi-user channel sounding

[redacted]

feedback. However, Abraham never describes or contemplates multi-user uplink transmission. Indeed, the portions of Abraham referenced by Dr. Hansen expressly contemplate sequential single-user feedback. For example. Abraham explains that after receiving feedback from a first station "then the AP may request another STA listed in the NDPA frame 402 to begin transmission of CSI feedback with CSI Poll 416." Abraham at [0073]; *see also* [0072]. Using this sequential method, "Any number of STAs may be identified in the NDPA frame 402, as will be discussed in additional detail below, and **the AP may transmit any number of CSI polls** and/or receive any number of CSI feedbacks or portions thereof." Abraham at [0073] (emphasis added).

962. Abraham never teaches multi-user channel sounding feedback—certainly not at any of the passages cited by Dr. Hansen. Hansen Report at ¶¶1650-1654. Dr. Hansen does not attempt to point to any multi-user feedback in Abraham.

963. For these reasons, it is my opinion that Abraham does not teach or suggest this limitation.

10.6.4.2 Abraham Fails to Teach or Suggest a "wherein the plurality of feedback frames from the plurality of receiving devices are received at a same time, and the NDPA frame includes allocation information of the plurality of subchannels." (18D)

964. Independent claim 18 of the '259 Patent requires "wherein the plurality of feedback frames from the plurality of receiving devices are received at a same time, and the NDPA frame includes allocation information of the plurality of subchannels." '259 at 24:44-46 ('259 cl. 18).

965. Dr. Hansen cites evidence that he asserts proves Sohn discloses this limitation. Hansen Report at ¶¶1845-1847. But Abraham does not teach or suggest this limitation, as described below.

966. Dr. Hansen cites passages from Abraham that describe control information contained in the NDPA frame and provided to receiving stations. Hansen Report at ¶¶1845-

[redacted]

1846 (citing Abraham at Figs. 5, 7A, [0076], [0084], [0085], [0088]). However, none of the Sohn passages cited by Dr. Hansen teach that the feedback frame is transmitted "wherein the plurality of feedback frames from the plurality of receiving devices are received at a same time." Indeed, none of these sections even describe the feedback transmitted by a station, to say nothing of simultaneous multi user feedback.

967. As I explained above with respect to element 1D and incorporate here, the '259 illustrates how channel sounding feedback is sent simultaneously by multiple STAs to an AP. On the other hand, Abraham has no commensurate disclosure, as I explained above.

968. Abraham never teaches multi-user channel sounding feedback—certainly not at any of the passages cited by Dr. Hansen. Hansen Report at ¶¶1845-1847. Dr. Hansen does not attempt to point to any multi-user feedback in Abraham.

969. For these reasons, it is my opinion that Abraham does not teach or suggest this limitation.

10.6.5 Lou Fails To Disclose Or Render Obvious Several '259 Claim Limitations

10.6.5.1 Lou Fails to Teach or Suggest "receiving a null data packet announcement (NDPA) frame from a transmitting device" (1A) and "transmitting a null data packet announcement (NDPA) frame to a plurality of receiving devices" (18A)

970. Independent claim 1 of the '259 Patent requires "receiving a null data packet announcement (NDPA) frame from a transmitting device." '259 at 22:36-37. Independent claims 18 claims this same step from the transmitting device's perspective: "transmitting a null data packet announcement (NDPA) frame to a plurality of receiving devices." '259 at 24:34-35.

971. Dr. Hansen cites evidence that he asserts proves Lou discloses these limitations. Hansen Report at ¶¶1598, 1790. But Lou does not teach or suggest these limitations as described below.

[redacted]

972. Dr, Hansen relies on one paragraph and two figures from Lou describing a CQI feedback mechanism. Hansen Report at ¶¶1598, 1790 (citing Lou at [0346], Figs. 50, 51. While this passage describes a "NDP announcement subfield," nothing in Lou describes the claimed NDPA frame.

973. For these reasons, it is my opinion that Lou does not teach or suggest this limitation.

10.6.5.2 Lou Fails to Teach or Suggest "wherein transmitting the feedback frame includes: transmitting the feedback frame to the transmitting device while a second feedback frame including subchannel information measured on the second subchannel is transmitted to the transmitting device by a second receiving device, the second subchannel being a subchannel that is allocated to the second receiving device among the plurality of subchannels" (1D)

974. Independent claim 1 of the '259 Patent requires "wherein transmitting the feedback frame includes: transmitting the feedback frame to the transmitting device while a second feedback frame including subchannel information measured on the second subchannel is transmitted to the transmitting device by a second receiving device, the second subchannel being a subchannel that is allocated to the second receiving device among the plurality of subchannels." '259 at 22:46-53 ('259 cl. 1).

975. Dr. Hansen cites evidence at he asserts proves Lou discloses this limitation. Hansen Report at ¶¶1655-1658. But Lou does not teach or suggest these limitations as described below.

976. Dr. Hansen primarily relies on discussion in Lou related to sounding generally. Hansen ¶¶1655-1656 (citing Lou at [0104], [0114], [0343], [0344]). These sections describe measuring channel quality on one or more subchannels and providing feedback top to the AP. *See* Lou [0344]. However, none of these sections describe " transmitting the feedback frame to the transmitting device while a second feedback frame … is transmitted to the transmitting device by a second receiving device" as claimed by the '259 Patent.

977. As I explained above in my discussion of Park and incorporate here, the '259 Patent illustrates how the feedback frame is sent by a first STA while a second feedback frame is

[redacted]

sent by a second STA. Lou has no commensurate disclosure as the ’259 Patent. Instead, Lou expressly explains that feedback is sent sequentially. Lou at [0289] (“The AP may schedule a group to transmit their beamforming reports one after another in a sequence in the sounding poll.”). To the extent Lou describes any multi-user uplink transmission (described as UL COBRA), Lou explains that this occurs after the sequential sounding process using “Req frames” and “Resp frames.” Lou at [0223] (“Req frames 3035a and 3035b and Resp frames 3040a and 3040b may be transmitted separately before a UL COBRA session to perform, for example, synchronization, power control, and/or sounding.”); *see also* Figs. 29, 30. As Lou explains, these Req frames are necessary to “refine the UL COBRA group” and are transmitted and received sequentially in every embodiment. Lou at [0219], [0225], Figs 29, 30. This process is illustrated in Figures 29 and 20 of Lou:

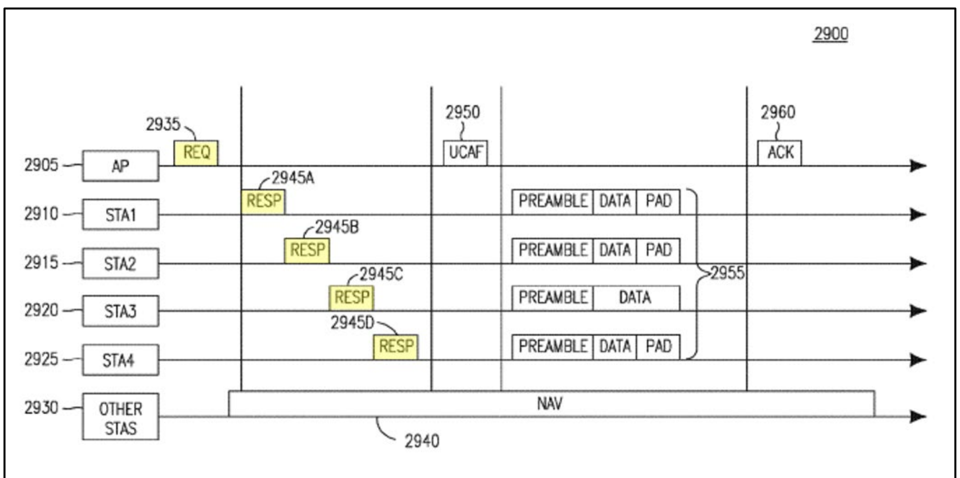


FIG. 29

[redacted]

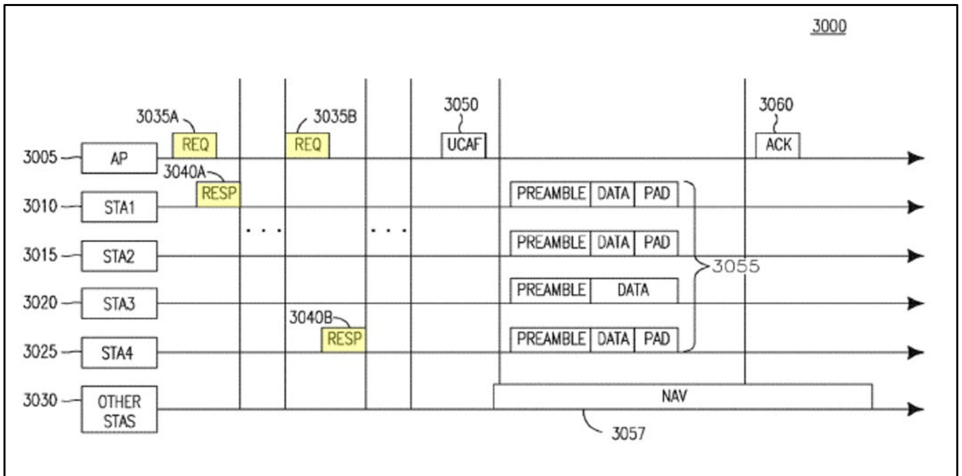


FIG. 30

978. Lou never teaches multi-user channel sounding feedback—certainly not at any of the passages cited by Dr. Hansen. Hansen Report at ¶¶1655-1658. Dr. Hansen does not even point to any multi-user feedback in Lou.

979. For these reasons, it is my opinion that Lou does not teach or suggest this limitation.

10.6.5.3 Lou Fails to Teach or Suggest a "wherein the plurality of feedback frames from the plurality of receiving devices are received at a same time, and the NDPA frame includes allocation information of the plurality of subchannels." (18D)

980. Independent claim 18 of the '259 Patent requires "wherein the plurality of feedback frames from the plurality of receiving devices are received at a same time, and the NDPA frame includes allocation information of the plurality of subchannels." '259 at 24:44-46 ('259 cl. 18).

981. Dr. Hansen cites evidence that he asserts proves Lou discloses this limitation. Hansen Report at ¶¶1848-1851. But Lou does not teach or suggest this limitation, as described below.

982. As with limitation 1D, Dr. Hansen primarily relies on discussion in Lou related to sounding generally. Hansen Report at ¶¶1655-1656 (citing Lou at [0104], [0114], [0343], [0344]). Indeed Dr. Hansen cites the same sections of Lou as for the prior element. *Compare* Hansen Report at ¶¶1848-1851 *with* Hansen Report at ¶¶1655-1656. Thus, as I explained above with respect to element 1D and incorporate here, the '259 illustrates how

[redacted]

channel sounding feedback is sent simultaneously by multiple STAs to an AP. On the other hand, Lou has no commensurate disclosure, as I explained above.

983. Lou never teaches multi-user channel sounding feedback—certainly not at any of the passages cited by Dr. Hansen. Hansen Report at ¶¶1848-1851. Dr. Hansen does not attempt to point to any multi-user feedback in Lou.

984. For these reasons, it is my opinion that Lou does not teach or suggest this limitation.

10.6.6 A POSITA would not have combined Chun, Park, Sohn, Abraham, and/or Lou

985. Dr. Hansen discusses why he believes a skilled artisan would have been motivated to combine Chun, Park, Sohn, Abraham, and Lou. Hansen Report at ¶¶1853-1865.

986. Dr. Hansen states in ¶ 1853 that he believes Chun, Park, Sohn, Abraham, and Lou are "analogous to the inventions claimed in the '259 Patent" and "a person of ordinary skill would have had a reasonable expectation of success in combining these references." Dr. Hansen does not cite any evidence or provide any analysis in support of these opinions.

987. As an initial matter, as shown above, Chun is not prior art to the '259 Patent. Also as shown above, Chun, Park, Sohn, Abraham, and Lou are different from the '259 patent in a number of important ways. Likewise, each of these references are different from one another in important ways, and in each reference Dr. Hansen points to different features as allegedly disclosing the claim elements. For example, each reference discloses different feedback mechanisms, polling techniques, resource allocation methods, and transmission sequences, and in many cases a feature that is present in one reference will be completely absent from the other references. Dr. Hansen makes no effort to address or reconcile these differences, nor does he explain ***how*** a POSITA would able to successfully combine these references.

988. Dr. Hansen states in ¶ 1854 that the references are "analogous art to the claimed invention because the references are from the same field of endeavor as the claimed invention." He bases this argument entirely on his position that each reference relates to

[redacted]

WLAN and the IEEE 802.11 standards. However, he does not explain how the prior art references, which only describe single user feedback, are analogous to the '259 Patents teaching of multi-user feedback mechanisms

989. Dr. Hansen states in ¶ 1855 that the references are "analogous art to the claimed invention also because each reference is reasonably pertinent to the problem faced by the inventor." Again, he does not explain or justify this statement and does not say what he believes is the problem being addressed. It appears that ¶1855 of Dr. Hansen's report is a recitation of legal boilerplate with no analysis.

990. Dr. Hansen in ¶¶ 1856-1860 block quotes several passages from each of Chun, Park, Sohn, Abraham, and Lou and states without explanation that "A POSITA would appreciate that [the reference] discloses these teachings, suggestions, and motivations in context of networks based on IEEE 802.11 standards, including applicability to IEEE 802.11ax standards." However, many patents and publications reference the 802.11 standard, and mere references to 802.11 does not mean that two references are analogous or compatible, nor does it mean that a POSITA would be motivated to combine them or even that it would be physically possible to combine them. A search of the PTO database shows that more than 400,000 patents and patent applications mention "802.11." Moreover, each of the five references has different dates and their references to "802.11" relate to different versions of the standard. Some of the references describe systems and techniques that are not used in 802.11, such as Lou's COBRA transmission methods. I disagree that references to "IEEE 802.11 standards" would teach or suggest to a POSITA that the references are analogous or can be combined.

991. Dr. Hansen's statements in ¶ 1861 appear to be more legal boilerplate. He states that that "it would have been obvious for a POSITA to combine the teachings of any combination of the above references, using known methods as disclosed in the references, to yield predictable results" but he does not explain why he believes this, nor does he

[redacted]

explain what the "methods" or "results" would be. In my opinion, Dr. Hansen's statements in ¶ 1861 do not make sense and are unsupported.

992. Dr. Hansen states in ¶ 1862 that "[o]ne exemplary combination of prior art that renders the asserted claims obvious is Chun in view of Sohn and/or Lou" and states that all three are directed to "WLAN" technology. Then, in ¶ 1863, Dr. Hansen block quotes Lou and concludes that "A POSITA would be motivated to modify Chun to make the channel information in the control field include SNR information for the "one or more sub-channels" assigned by the AP, as taught by Lou, to enable a "more efficient" sounding procedure." However, this conclusion is nothing more than conclusion. Nothing Dr. Hansen points to in Chun or Lou suggests modifying control fields to include channel sounding information. Indeed, Dr. Hansen's quote from Lou suggests that control fields sent by an AP are entirely separate from feedback sent by a station. Dr. Hansen provides no explanation for why one would combine Chun with Sohn. Moreover, as I explain above, Chun is not prior art and therefore cannot be used in any obviousness combinations.

993. Dr. Hansen states in ¶ 1864 that "[a]nother exemplary combination of prior art that renders the asserted claims obvious is Park in view of Chun and/or Sohn and/or Lou." and again states that all three are directed to "WLAN" technology and describe channel sounding methods. Then Dr. Hansen block quotes Lou. However, Dr. Hansen ever explains how or why these references could be combined, nor does he explain what the results would be. In my opinion, Dr. Hansen's statements in ¶ 1864 do not make sense and are unsupported. Moreover, as I explain above, Chun is not prior art and therefore cannot be used in any obviousness combinations.

994. Dr. Hansen states in ¶ 1865 that "it would have been obvious to combine any combination of the above references with Abraham" and again notes that Abraham is directed to WLAN technology. Dr. Hansen then states that "Abraham specifically discloses an NDPA frame indicating information corresponding to a predetermined length and an NDA frame including allocation information of a subchannel" and makes the bare assertion

[redacted]

that "It would have been well within the ordinary skill in the art at the time of the invention to modify any of the references discussed above with the teachings of Abraham." But, Dr. Hansen never explains why or how such a modification would be made, or what the expected results would be.

995. In sum, Dr. Hansen provides no technical justification for the desirability or feasibility of combining any of the references. His discussions of topics like "WLAN" and "802.11" appear to be attempts to use hindsight to justify his preferred combinations. He also does not establish that any such combination, even if possible, would disclose all elements of any claim.

11. THE ART REFERENCED IN THE HANSEN REPORT DOES NOT INVALIDATE THE ASSERTED CLAIMS OF THE '738 PATENT

11.1 Overview of the '738 Patent

996. The '738 Patent is titled "Acknowledgment Method and Multi-User Transmission Method." '738 Patent (ATLAS-00008981–9022) at Title Page (ATLAS-00008982). It was invented by Yongjin Kwon, Jongee Oh, Hyungu Park, Je-Hun Lee, Hong Soog Kim, Heejung Yu, Minho Cheong, and Hyoung Jin Kwon. The '738 Patent claims priority to provisional application No. 61/975,622 filed April 4, 2014 and provisional application No. 61/981,427 filed April 18, 2014. *Id.* at Title Page. The '738 Patent issued November 21, 2017. *Id.*

997. The prior versions of the 802.11 standard did not describe or support the ability to have multiple stations transmit uplink frames at the same time, as part of an uplink multi-user (UL MU) transmission. One of the challenges in implementing such UL MU transmissions from different user devices in 802.11 was that there was no mechanism available to coordinate the simultaneous responses from the plurality of disparate station devices. The '738 Patent describes a technique for providing that coordination function, with a protocol that supports multiple forms of UL MU transmissions with a high degree of efficiency. Specifically, the '738 Patent discloses using a downlink frame from an

[redacted]

access point that coordinates a simultaneous response from multiple different stations, which each respond to the downlink frame by transmitting an uplink frame as part of a multi-user transmission together with other stations. This coordinating downlink frame is a physical (PHY) downlink frame that includes uplink setup information. The 802.11ax standard implements this technique, and provides a downlink transmission that includes a Trigger frame.

998. Thus, the ’738 Patent teaches improvements for initiating multi-user uplink communications through the use of a frame that includes uplink setup information. The access point transmits a downlink frame to a plurality of stations that includes uplink setup information, and the uplink setup information is used to initiate and coordinate the responsive UL MU transmission. The ’738 Patent details the structure and information to provide in the uplink setup information, which includes a common information portion intended for each of the stations participating in the UL MU transmission, and a dedicated information portion that includes information specific to each of those stations. The stations use this information to construct their uplink transmission. The access point then responds to the UL MU transmission with a multi-user acknowledgement to collectively acknowledge successful receipt of the simultaneous multi-user uplink transmissions. Thus, the ’738 Patent covers a particular format for a physical downlink frame that is used to generate a multi-user response from a plurality of station devices. In addition, the patent describes specific fields to include in the common information portion and the dedicated user specific information portion that support both multi-user OFDMA and MU-MIMO uplink transmissions.

999. The setup information included in the downlink frame includes common information that is common to all stations joining in the UL MU transmission and dedicated information specific to each. ‘738 at 22:31-38. The common information is used by all of the STA for their UL MU transmission, and that common information includes information that is related functionally to the total number of data streams, (*i.e.*, space time streams to

[redacted]

be transmitted by the responding stations). The common information may also include the transmission length of the UL data frame. ‘738 at 22:39-46.

1000. Conversely, the dedicated information is user specific information for each station, and may include the number of data streams to be transmitted by that particular station, the transmission power, and the MCS to be used by the station. ‘738 at 22:54-66. The dedicated information may further include information on the long training fields (HEW-LTF) to be used by that particular STA. ‘738 at 23:4-11.

1001. The AP that receives the UL MU transmissions from the multiple stations then transmits an acknowledgement frame indicating receipt of the UL MU transmission from the plurality of stations. ‘738 at 17:18-22. This acknowledgment frame may be a Block ACK frame for the multiple stations from whom the UL MU transmission was received successfully. ‘738 at 17:40-43; Figure 16. The acknowledgement frame may include information for each STA and information about whether the UL MU transmission from the corresponding STA has been received. ‘738 at 19:41-48.

11.2 Priority for ’738 Patent

1002. As indicated on the front of the ’738 Patent, the application that issued as the ’738 Patent was filed on April 3, 2015 as US Application No. 14/678,724. That application claimed priority to 2 different provisional application: (i) Provisional application No. 61/975,622 (the “’622 Provisional”) filed on April 4, 2014; and (ii) Provisional application No. 61/981,427 (the “’427 Provisional”), filed on April 18, 2014.

[redacted]

(54) **ACKNOWLEDGEMENT METHOD AND MULTI USER TRANSMISSION METHOD**

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(72) Inventors: **Yongjin Kwon**, Daejeon (KR); **Jong-Ee Oh**, Irvine, CA (US); **Hyungu Park**, Daejeon (KR); **Je-Hun Lee**, Irvine, CA (US); **Hong Soog Kim**, Daejeon (KR); **Heejung Yu**, Daegu (KR); **Minho Cheong**, Irvine, CA (US); **Hyoung Jin Kwon**, Daejeon (KR)

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 112 days.

(21) Appl. No.: **14/678,724**

(22) Filed: **Apr. 3, 2015**

(65) **Prior Publication Data**

US 2015/0288501 A1 Oct. 8, 2015

Related U.S. Application Data

(60) Provisional application No. 61/981,427, filed on Apr. 18, 2014, provisional application No. 61/975,622, filed on Apr. 4, 2014.

1003. The ’622 Provisional application is titled “UL MU-MIMO in wireless LAN system.” It includes a disclosure that supports the issued claims of the ’738 Patent.

1004. The ’738 Claims 1-8 are provided below. To the extent that TP-Link pursues invalidity of claims 9-16, my analysis of those claims track my analysis for Claims 1-8. I have separated claim 1 of the ‘738 Patent into claim limitations as follows. Note that this organization differs from the breakdown used by Dr. Hansen. I did this to break some of the limitations into more discrete portions since some of these limitations have multiple concepts. Further, this breakdown generally tracks the divisions used by Dr. Shoemake in his infringement report.

[redacted]

Claim 1
[1a] A method of operating an access point in a wireless communication network, the method comprising:
[1b] generating downlink data;
[1c] generating uplink setup information, the uplink setup information including a first information to be used for uplink multi-user transmission;
[1d] transmitting the downlink data and the uplink setup information in a single physical downlink frame to a plurality of stations;
[1e] simultaneously receiving multiple uplink frames from multiple stations of the plurality of stations; and
[1f] transmitting an acknowledgement frame to the multiple stations after a successful reception of the multiple uplink frames,
[1g] wherein the uplink setup information includes a common information portion and a dedicated information portion,
[1h] the common information portion includes a second information being common to all of the plurality of stations to receive the uplink setup information,
[1i] and the dedicated information portion includes respective third information specific to each of the plurality of stations to receive the uplink setup information, and
[1j] wherein the second information is a function of a total number of space time streams to be used to transmit the multiple uplink frames.

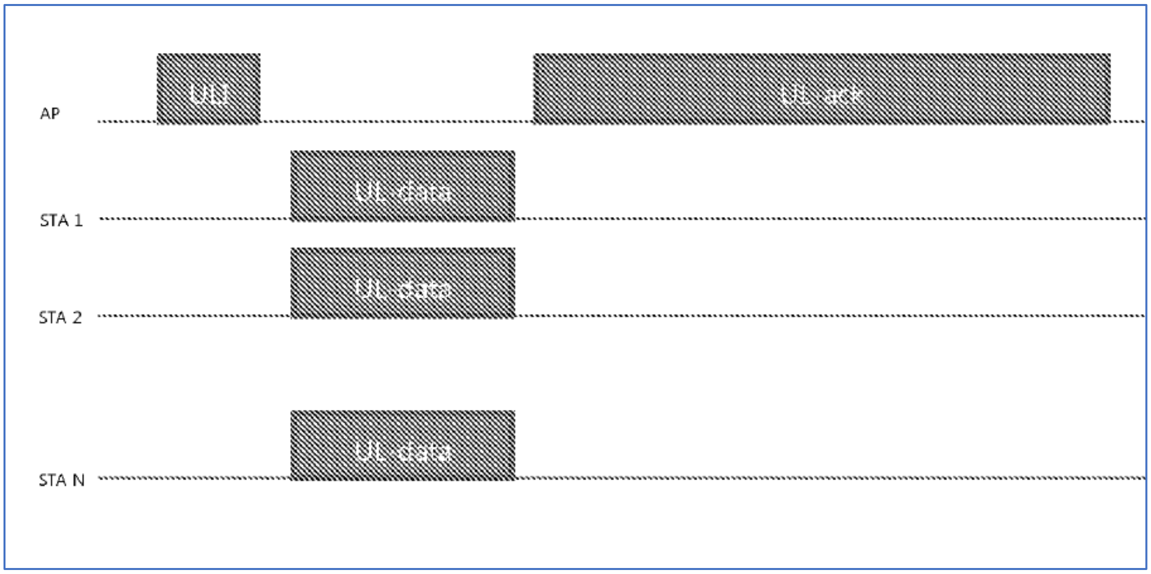
Support for each of these limitations in Claim 1 of the ’738 patent can be found in the ’622 provisional, as explained in the subsections which follow.

11.2.1 Limitation 1a: A method of operating an access point in a wireless communication network

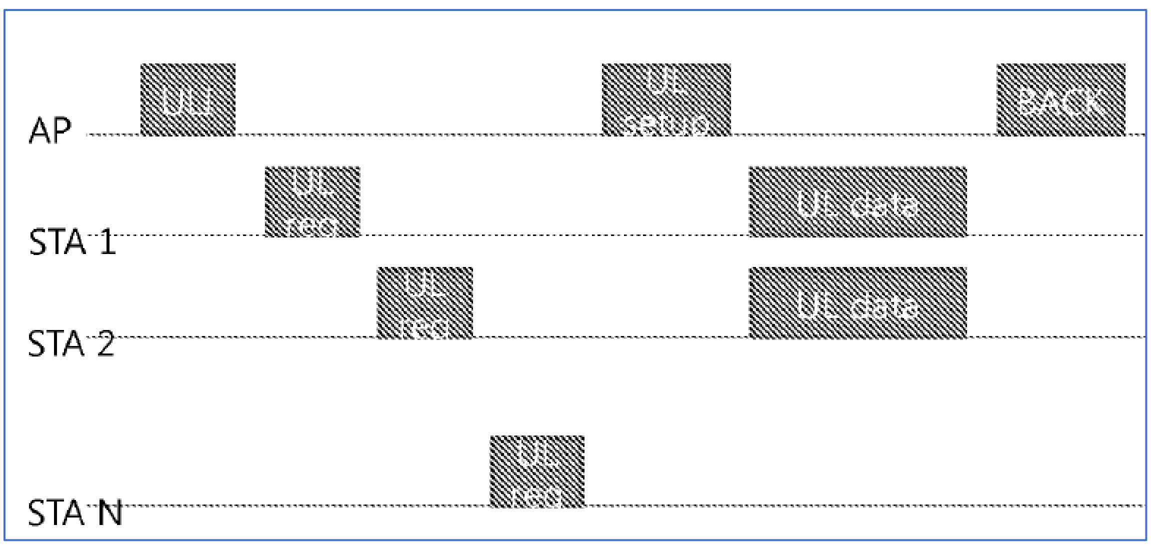
1005. The Summary of the ’622 provisional plainly indicates that this application is directed to an access point with multiple antennas that can simultaneously transmit and receive data from multiple stations in a wireless local area network (WLAN). ’622 Provisional at 1/11 (subsequent cites to the ’622 provisional application in this and the subsequent subsections will only reference the page where the discussion is located, without noting that the provisional disclosure is 11 pages long). *See also* Background which references the 802.11ac standard and the concept of both downlink and uplink MU-MIMO wireless transmissions using multiple antenna.

[redacted]

1006. For example, the ’622 Provisional includes figures that are similar to Figures 15 and 22 of the ’738 Patent, as shown on pages 1 and 4 of the ’622 Provisional. These figures show uplink setup information being transmitted by an access point to a plurality of stations, and the plurality of stations responding with a multi-user uplink transmission that then is acknowledged by the access point:



’622 Provisional, Page 1.



’622 Provisional, page 4.

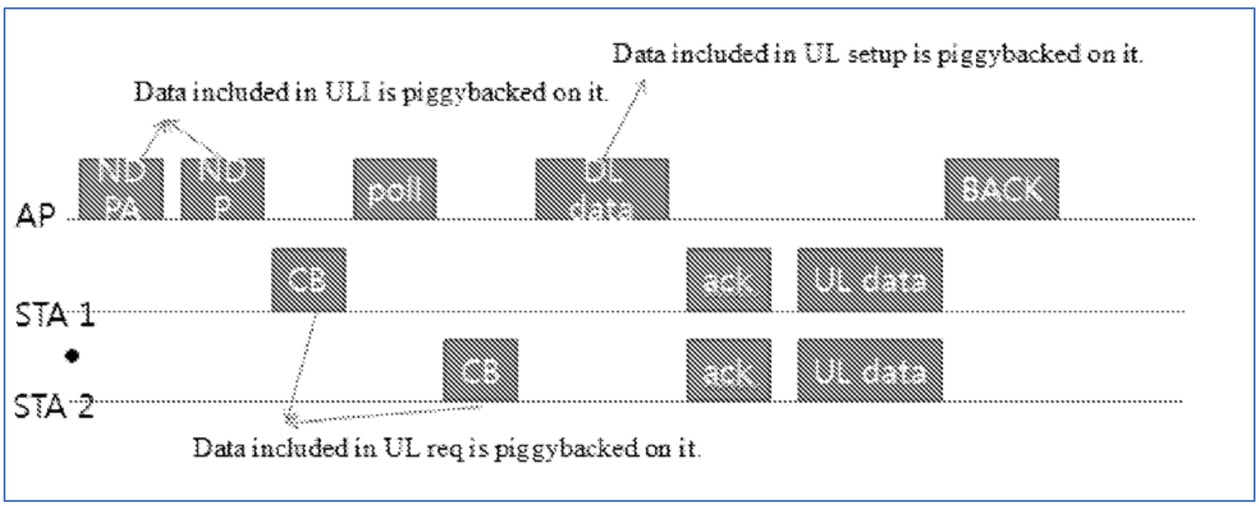
[redacted]

1007. The ’622 provisional Objective again references UL MU-MIMO transmissions in a WLAN (wireless local area network). It also references the frame exchanges between an AP and multiple STAs, noting that the invention defines a new frame for supporting UL MU-MIMO transmissions, while operating consistently with previous WLAN protocols:

> **4. Objective**
>
> The present invention suggests using the UL MU-MIMO for enhancing frequency efficiency of the WLAN, suggests a new frame and its elements for the UL MU-MIMO, and suggests a procedure for exchanging frames between the AP and the STAs under various circumstances. Accordingly, the present invention can efficiently support the UL MU-MIMO with maintaining the previous WLAN protocol.

11.2.2 Limitation 1b: generating downlink data

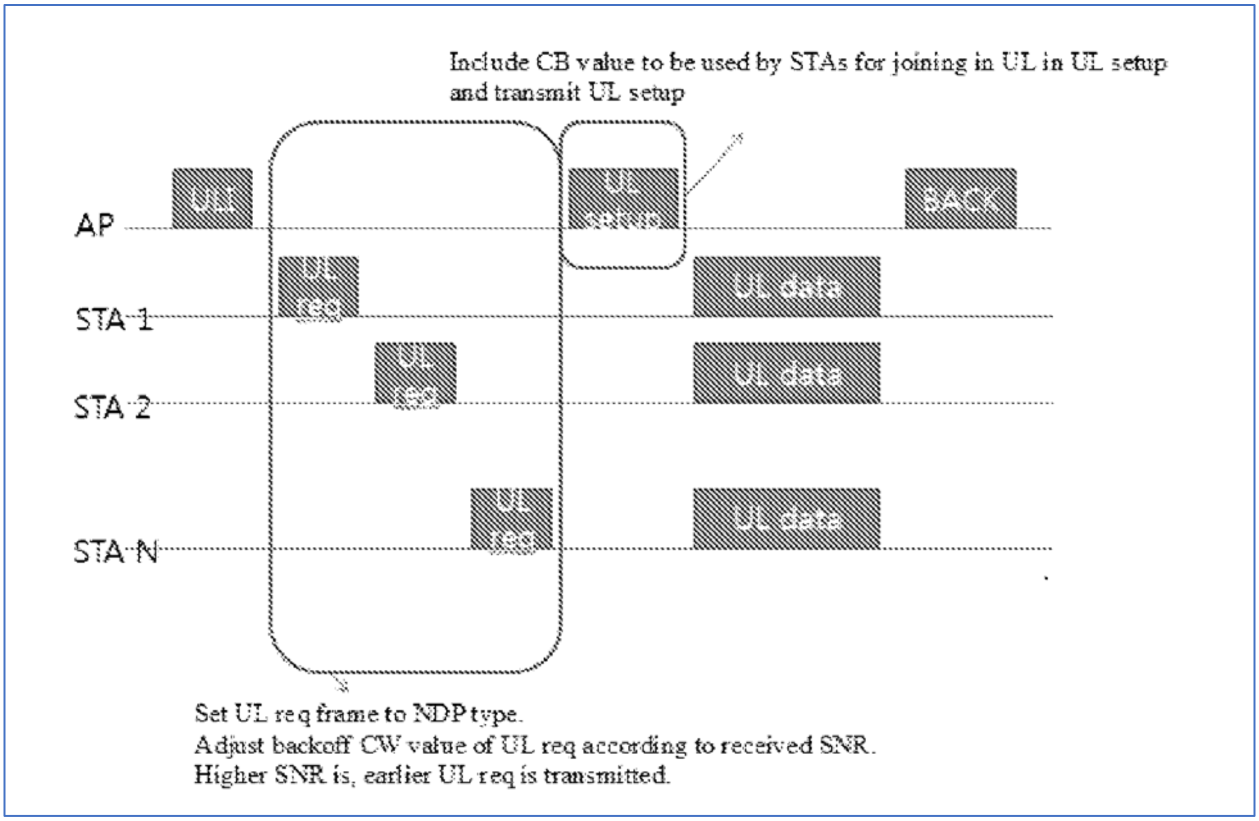
1008. The ’622 provisional provides several examples in which the AP generates downlink data to be transmitted with uplink setup information. For example, the figure at the top of page 9 of the provisional shows “Data included in UL setup is piggybacked on it”:



Thus, in this embodiment of the ’622 provisional, the AP generates downlink data, and this downlink data is transmitted together with uplink setup information. Stated differently, the uplink setup information is piggybacked on a downlink data frame.

[redacted]

1009. As another example, the figure at the top of page 8 shows UL setup information transmitted with compressed beamforming (CB) data for the multiple responding STAs:



Both of these figures show that the AP is transmitting downlink data (which it necessarily generated) together with uplink setup information.

11.2.3 Limitation 1c: generating uplink setup information, the uplink setup information including a first information to be used for uplink multi-user transmission

1010. The '622 provisional discloses generating uplink setup information that includes information to be used for an UL MU transmission throughout the provisional application. As noted relative to Limitation 1a, the Objective of the '622 provisional states that the invention defines a new frame for supporting UL MU-MIMO transmissions, while operating consistently with previous WLAN protocols

1011. The '622 Provisional explains that UL MU-MIMO "is a scheme where a plurality of STAs simultaneously transmit data to an AP …" and "the plurality of STAs should

[redacted]

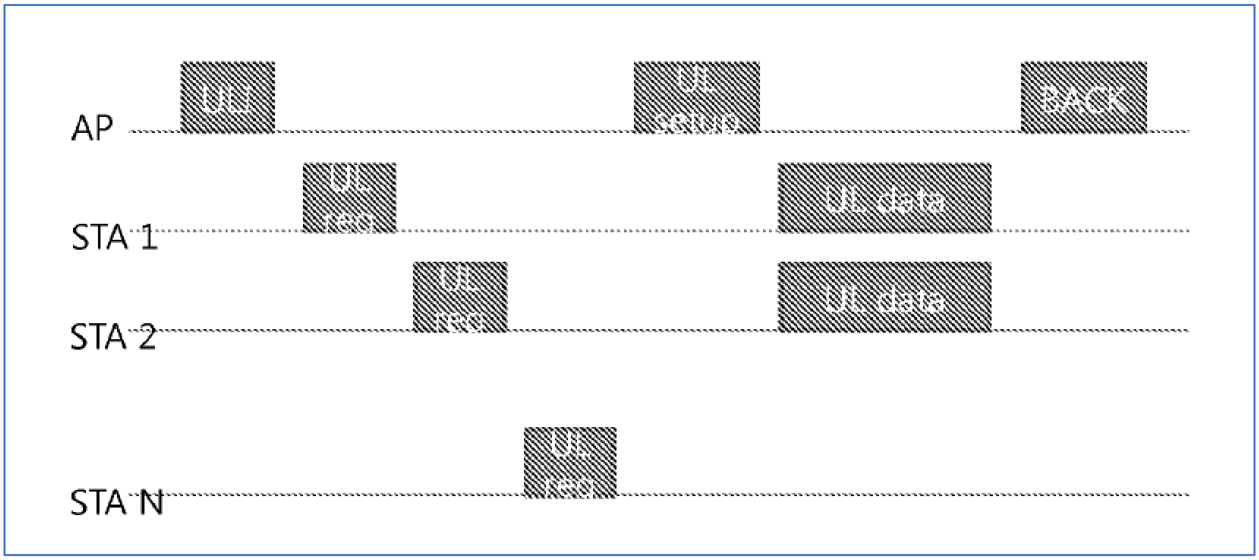
transmit frames like a single transmitter." '622 Provisional at 2. Further, "[i]nitiation of the UL-MIMO should be performed in a scheduled access scheme not a channel sensing scheme" with the AP initiating the UL-MIMO transmission with a downlink frame. '622 Provisional at 3.

1012. The '622 Provisional states that the AP initiates an UL MU-MIMO transmission by transmitting an UL setup frame, with information in the setup frame corresponding to each station:

> Description for FIG. 1: the AP initiates the UL MU-MIMO transmission by transmitting a UL MU-MIMO initiation (ULI) frame to a STA group including STA1 to STAN. The STAs of the STA group receiving the ULI frame transmits a UL MU-MIMO request (UL req) frame, thereby transferring information on a data state of its queue and a path loss between the AP and its position to the AP. When a transfer of channel information is required according to a request of the AP, a frame structure of the UL req may be transmitted by extending the number of LTFs of the UL req frame by the number of antennas like an NDP frame of the IEEE 802.11ac. The AP finally selects the STAs for joining in the UL MU-MIMO based on such information, and transmits a UL MU-MIMO setup (UL setup) frame including information corresponding to each STA. The UL MU-MIMO setup includes a structure of LTFs, a transmission power, MCS (modulation and coding scheme) information, and a data length to be used by each STA. As such, when the advanced preparation for the UL MU-MIMO transmission is completed, the STAs for joining in the UL MU-MIMO transmission transmit a UL data frame in accordance with the information of the UL setup frame. The AP notifies the STAs of whether the corresponding frames have been received, through a BACK (block acknowledgement) frame. An interval between frames is a predetermined interval such an SIFS or a PIFS.

'622 provisional at 4. The STAs transmit an uplink frame "in accordance with the information of the UL setup frame." The figure at the top of page 4 shows a frame exchange with UL setup information and the responsive UL MU frames:

[redacted]



1013. According to the ’622 provisional, “the AP transmits a UL setup packet including information of transmission of each STA and starts the UL-MIMO transmission.” ’622 Provisional at 5. The UL setup packet includes:

- UL setup packet
  - Total number of HEW-LTFs to be used for UL MU-MIMO
  - Total number of OFDM symbols or length
  - STA information
    - STA Address (to be participated in UL-MU)
    - used HEW-LTF rows to be used by each STA (toggle 형태?)
    - # of streams to be transmitted by the corresponding STA
    - MCS to be used by the corresponding STA
    - transmission power information of by the corresponding STA

’622 provisional at 5.

1014. The ’622 provisional reconfirms that the STAs configure the UL MU frames using the information of the UL setup frame:

> number of OFDM symbols included in the UL setup. The STAs configure the UL data frames by using the information of the UL setup frame and simultaneously transmit the UL data frames to the AP. In this case, each STA uses the transmission power provided by the AP and corrects the carrier

’622 provisional at 6.

[redacted]

1015. The UL setup frame that is transmitted by the AP to the STA is described in more detail on page 7 of the provisional:

	IEEE 802.11ac/n)	
UL setup frame (AP → STA)	Common information	The total number of data streams of all STAs joining in the UL
		A transmission length of a UL data frame (the number of OFDM symbols or a transmission time)
	Dedicated information	An address of the corresponding STA
		The number of data streams to be used by the corresponding STA
		The LTF set to be used by the corresponding STA
		A transmission power of the corresponding STA
		A transmission MCS of the corresponding STA
		Beam information for the corresponding STA (compressed beam)
UL data frame (STA → AP)	Each STA transmits a frame in accordance with information the UL setup frame.	
	Each STA transmits a frame after correcting the carrier frequency offset in advance as a value that is equal to a value used at the UL request frame transmission.	

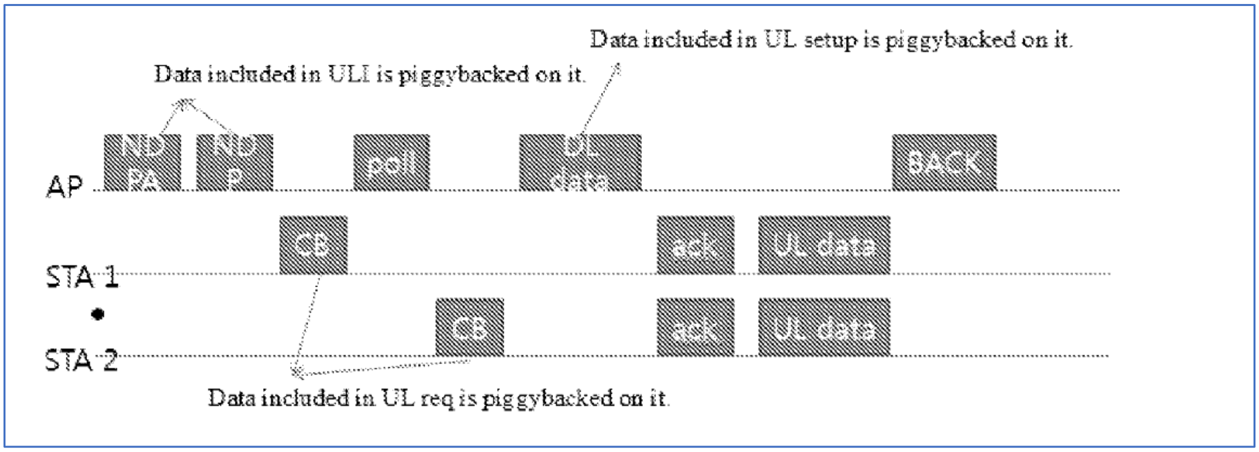
’622 provisional at 7. Further, as this table notes relative to the UL data frame, “[e]ach STA transmits a frame in accordance with information [in] the UL setup frame.” The ’622 provisional describes Limitation 1c.

11.2.4 Limitation 1d: transmitting the downlink data and the uplink setup information in a single physical downlink frame to a plurality of stations

1016. As shown above relative to Limitation 1b, the downlink data is transmitted together with uplink setup information. For example, the top of page 9 of the ’622 provisional shows “Data included in UL setup is piggybacked on it.” This combining together of uplink

[redacted]

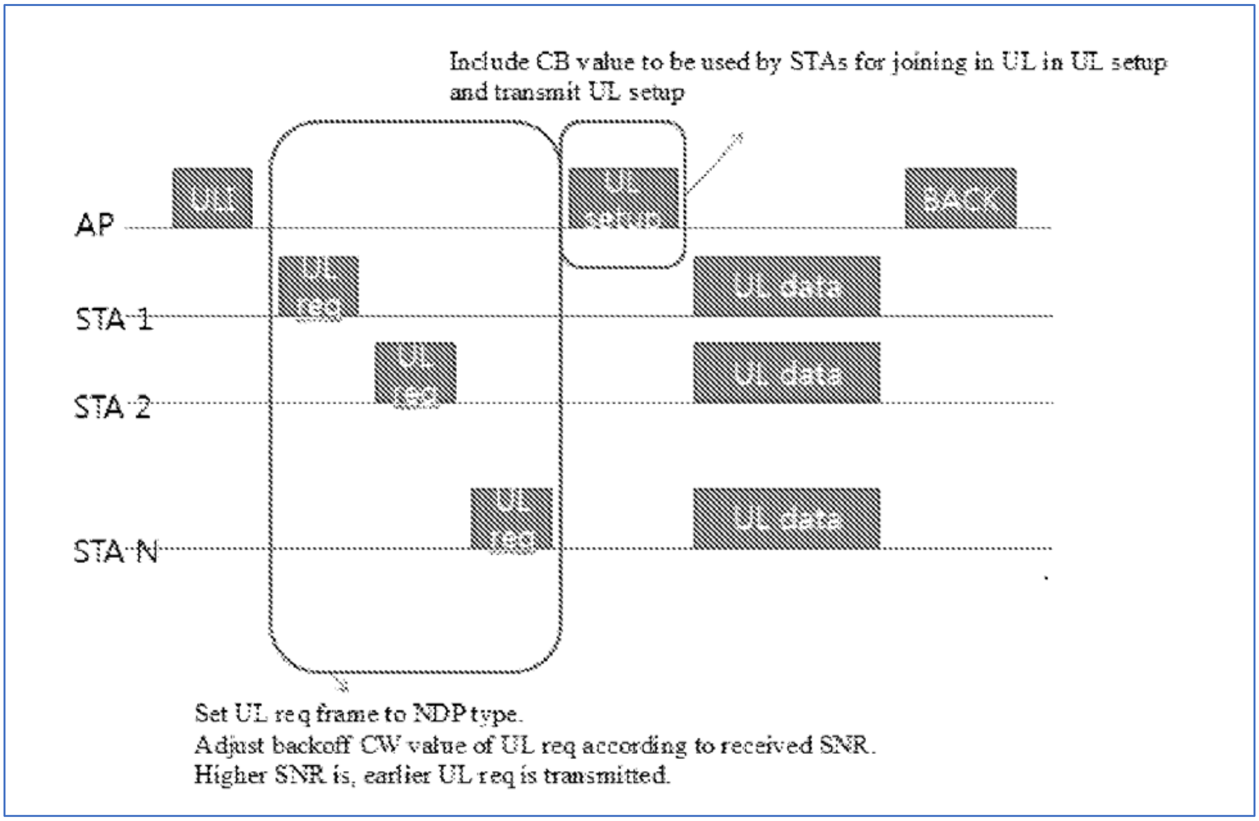
setup information and downlink data is consistent with the requirements of this claim limitation :



’622 provisional at 9. Specifically, this figure shows a DL data frame, with UL setup information “piggybacked” in that data frame, consistent with Limitation 1d.

1017. The figure at the top of page 8 shows UL setup information that is transmitted with compressed beamforming data to be used by the STAs as part of joining n the UL MU transmission:

[redacted]



’622 provisional at 8. Further, the ’622 provisional states with regard to this embodiment, that the frame aggregates the uplink setup frame with other available data, as the figures on pages 8-10 illustrate.

1018. These examples show that the AP transmits downlink data together with uplink setup information.

11.2.5 Limitation 1e: simultaneously receiving multiple uplink frames from multiple stations of the plurality of stations

1019. As shown in the figures referenced above, the plurality of STAs will transmit multiple uplink frames that are received simultaneously by the AP. The ’622 provisional describes an UL data frame sent by each of the stations in accordance with the UL setup frame:

[redacted]

UL data frame (STA → AP)	Each STA transmits a frame in accordance with information the UL setup frame.
	Each STA transmits a frame after correcting the carrier frequency offset in advance as a value that is equal to a value used at the UL request frame transmission.

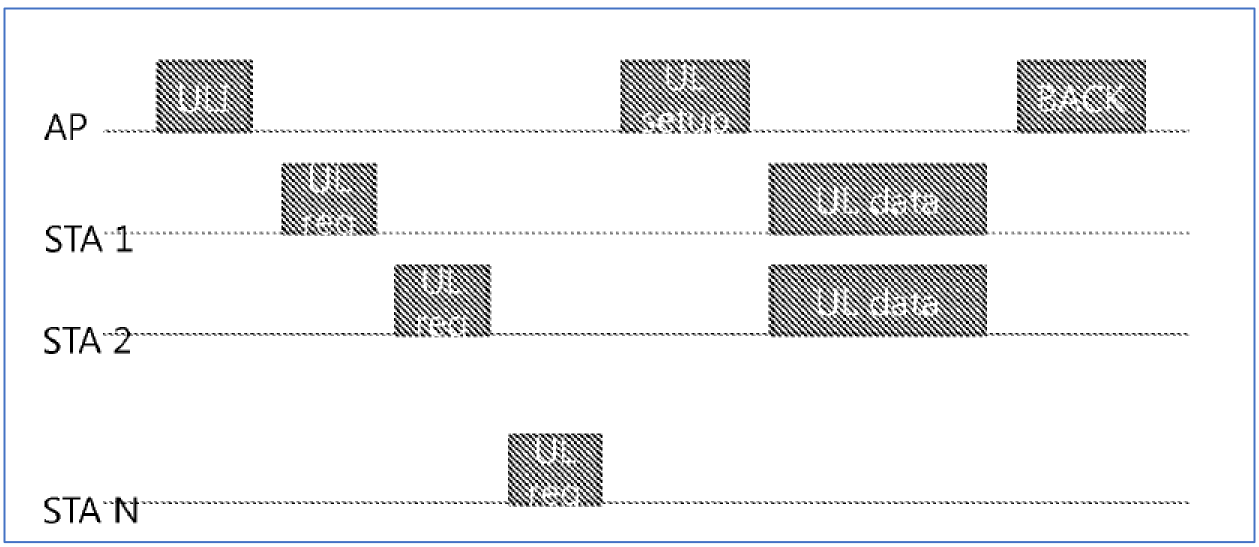
’622 provisional at 7.

1020. This simultaneously transmitted UL MU frame is referenced repeatedly in the ’622 provisional application, often as an UL MU-MIMO transmission:

> The UL MU-MIMO scheme is a scheme where a plurality of STAs simultaneously transmit data to an AP and the AP separates and demodulate the data to simultaneously support the plurality of STAs. In this scheme, a plurality of transmitters that are spatially separated transmit data streams of the transmitters in a point-to-point MIMO scheme. Therefore, the plurality of STAs should transmit frames like a single transmitter. Accordingly, the plurality of transmitters should start to transmit the frames at the same time, and a power difference according to a distance between each transmitter and a receiver should be compensated in advance. Furthermore, carrier frequency offsets should be

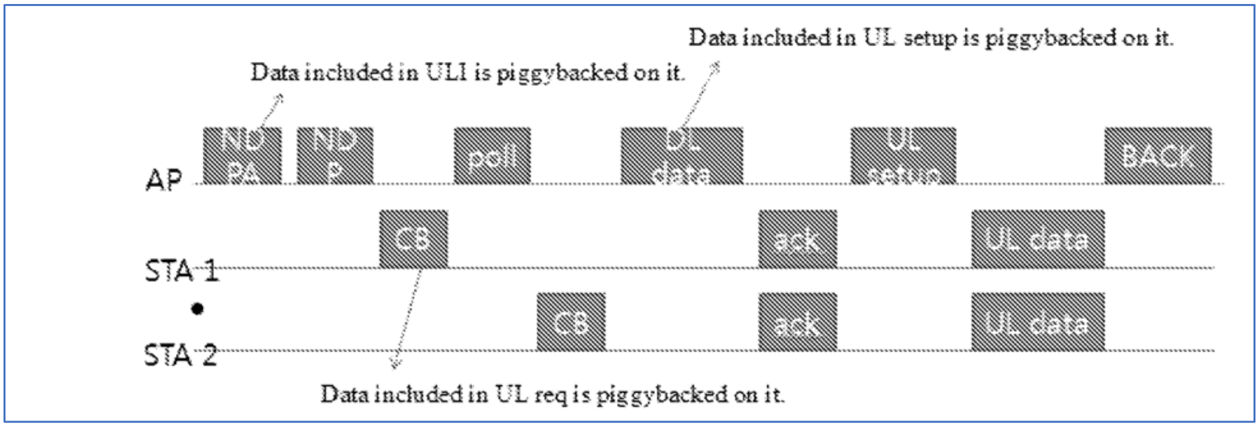
’622 provisional application at 2; *see also* ’622 provisional at 6 (“The STAs configure the UL data frames by using the information of the UL setup frame and simultaneously transmit the UL data frames to the AP.”)

1021. The figure at the top of page 3 illustrates the simultaneous nature of the UL MU transmissions, which are initiated by the UL setup information:

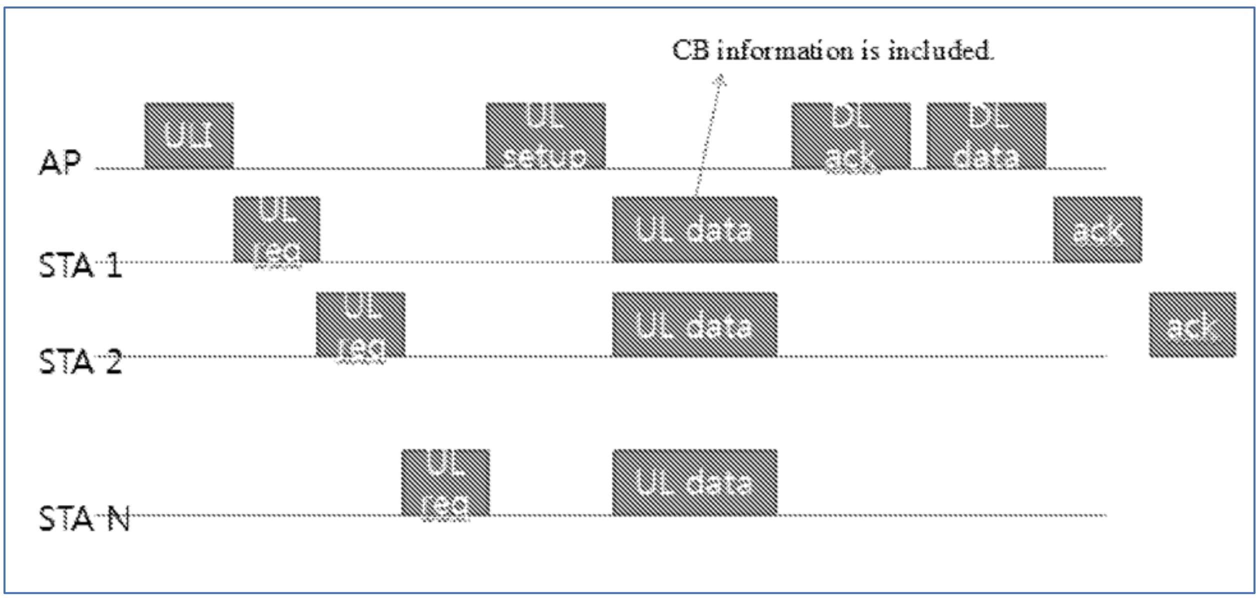


[redacted]

’622 provisional application 4. Similarly, the figures on pages 8-10 all show UL MU transmission received simultaneously by an AP. The following figures are exemplary:



Provisional at 8



Provisional at 10.

1022. These figures show a coordinated UL MU transmission from multiple STAs that are received simultaneously by the AP, consistent with Limitation 1e.

11.2.6 Limitation 1f: transmitting an acknowledgement frame to the multiple stations after a successful reception of the multiple uplink frames

1023. The ’622 provisional application discloses the AP transmitting an acknowledgment frame in response to successfully receiving the UL MU transmissions from the multiple

[redacted]

STAs. For example, on page 4, the '622 provisional discloses sending a block acknowledgement (BACK) frame to indicate whether the uplink frames have been received:

> scheme) information, and a data length to be used by each STA. As such, when the advanced preparation for the UL MU-MIMO transmission is completed, the STAs for joining in the UL MU-MIMO transmission transmit a UL data frame in accordance with the information of the UL setup frame. The AP notifies the STAs of whether the corresponding frames have been received, through a BACK (block acknowledgement) frame. An interval between frames is a predetermined interval such an SIFS or a PIFS.

'622 provisional at 4.

1024. A Similar explanation can be found on page 6 of the '622 provisional, also describing a BACK frame:

> AP restores the data of each STA through demodulation. Furthermore, the AP notifies, through a BACK (block ACK) frame, whether the data frame of each STA has been successfully received in accordance with whether the demodulation is possible. The BACK includes information about whose data have been successfully received such that the STA in which the error has been occurred can be identified. Further, the ACK may provide whether there are more UL data (more UL data indication UDI).

'622 provisional at 6.

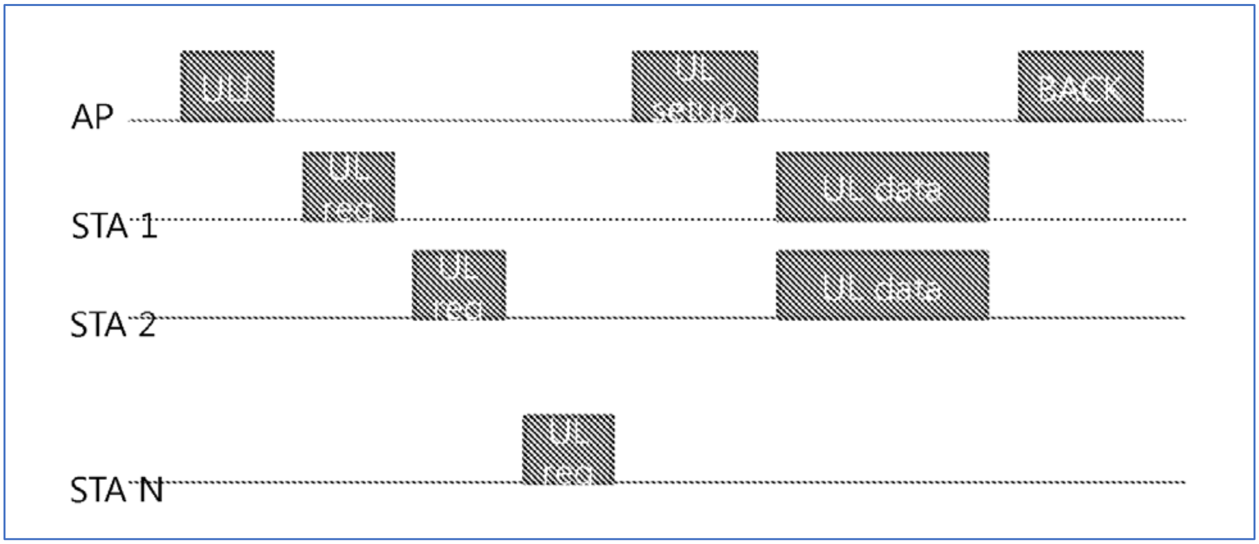
1025. The description of the frames that are configured and transmitted includes a BACK frame that is sent by the AP to indicate reception of the UL MU frame from the multiple STAs:

BACK frame (AP → STA)	Each STA can identify whether the transmitted data has been received.

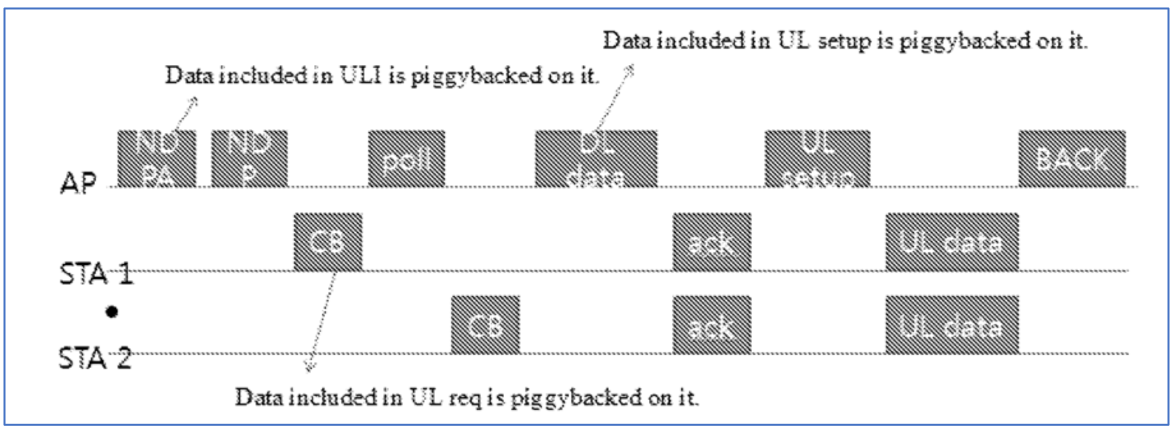
'622 provisional at 7.

1026. The figures provided throughout the '622 provisional show the inclusion of a BlockAck (BACK) frame:

[redacted]



’622 Provisional at 4.



’622 Provisional at 8.

11.2.7 Limitation 1g: wherein the uplink setup information includes a common information portion and a dedicated information portion

1027. The Provisional application also explains that the UL setup information includes “common information corresponding to all STAs and dedicated information for each STA,” and further explains the information that may be included in the common information portion and the dedicated information portion. ’622 Provisional at 5, 7. Thus, the provisional application plainly indicates the organization of the setup information, including into a common information portion and a dedicated information portion. Information included in the applicable frames is shown in the table on pages 6-7, and for

[redacted]

the UL setup frame, this specifically includes both "common information" and "dedicated information":

	IEEE 802.11ac/n)	
UL setup frame (AP → STA)	Common information	The total number of data streams of all STAs joining in the UL
		A transmission length of a UL data frame (the number of OFDM symbols or a transmission time)
	Dedicated information	An address of the corresponding STA
		The number of data streams to be used by the corresponding STA
		The LTF set to be used by the corresponding STA
		A transmission power of the corresponding STA
		A transmission MCS of the corresponding STA
		Beam information for the corresponding STA (compressed beam)

1028. Further, page 5 of the provisional also identifies the contents of the UL setup packet, including information that is common and that which correlates to STA information.

11.2.8 Limitation 1h: the common information portion includes a second information being common to all of the plurality of stations to receive the uplink setup information,

1029. The '622 provisional application explains that the common information is information that corresponds to all STAs that participate in the UL MU transmission:

determined result to the corresponding STAs through the UL setup. First, there are common information corresponding to all STAs and dedicated information for each STA. The common information includes the total number of data streams transmitted by the all STAs and a time length occupied by the UL transmission (the number of transmitted OFDM symbols, a transmission time). The total number of data streams can allow the STA to know the number of LTFs to be included in a UL data frame. The UL transmission length can allow the STA to transmit the frame in accordance with the length. If the data length is shorter than the transmission length, the STA transmits the UL

[redacted]

’622 provisional at 5.

1030. Further, the provisional on that same page and on page 7 reiterates the contents of the common information:

- UL setup packet
  - Total number of HEW-LTFs to be used for UL MU-MIMO
  - Total number of OFDM symbols or length

’622 Provisional at 5. The Table on page 7 specifically identifies the content of the “common information” portion:

	IEEE 802.11ac/n)	
UL setup frame (AP → STA)	Common information	The total number of data streams of all STAs joining in the UL
		A transmission length of a UL data frame (the number of OFDM symbols or a transmission time)

Provisional at 7.

1031. These provisions also identify some of the information that is to be included in the common information field, including the length of the UL transmission and information regarding the total number of streams to be transmitted by all STAs in the UL MU transmission.

11.2.9 Limitation 1i: the dedicated information portion includes respective third information specific to each of the plurality of stations to receive the uplink setup information

1032. The ’622 provisional indicates that the UL setup packet is organized with STA specific information, including various information including the STA address, transmission power and MCS to be used by the corresponding STA:

[redacted]

> The AP selects the STAs joining in the UL MIMO by using the above acquired information. Further, based on the selected result, the AP transmits a UL setup packet including information for transmission of each STA and starts the UL-MIMO transmission.
>
> - UL setup packet
>   - Total number of HEW-LTFs to be used for UL MU-MIMO
>   - Total number of OFDM symbols or length
>   - STA information
>   - STA Address (to be participated in UL-MU)
>   - used HEW-LTF rows to be used by each STA (toggle 형태?)
>   - # of streams to be transmitted by the corresponding STA
>   - MCS to be used by the corresponding STA
>   - transmission power information of by the corresponding STA

’622 provisional at 5.

1033. That same page identifies the UL setup frame as including a dedicated information portion. The contents of the dedicated information include an address of the corresponding STA, a transmission power to be used by that STA, the number of data streams to be transmitted by that STA, the LTF set to be used by a particular STA and MCS information to be used by each STA. ’622 provisional at 5-6. Similarly, the Table on page 7 of the provisional details the dedicated information included in the uplink setup frame:

UL setup frame (AP → STA)	Common information	The total number of data streams of all STAs joining in the UL
		A transmission length of a UL data frame (the number of OFDM symbols or a transmission time)
	Dedicated information	An address of the corresponding STA
		The number of data streams to be used by the corresponding STA
		The LTF set to be used by the corresponding STA
		A transmission power of the corresponding STA
		A transmission MCS of the corresponding STA
		Beam information for the corresponding STA (compressed beam)

[redacted]

Thus, the '622 provisional identifies that the dedicated information portion of the uplink setup frame includes information that is specific to particular stations.

11.2.10 Limitation j: wherein the second information is a function of a total number of space time streams to be used to transmit the multiple uplink frames.

1034. The '622 provisional explains that the UL setup packet includes the "[t]otal number of HEW-LTFs to be used for UL MU-MIMO":

> The AP selects the STAs joining in the UL MIMO by using the above acquired information. Further, based on the selected result, the AP transmits a UL setup packet including information for transmission of each STA and starts the UL-MIMO transmission.
>
> - UL setup packet
>   - Total number of HEW-LTFs to be used for UL MU-MIMO

'622 provisional at 5.

1035. Page 5 of the provisional further notes that there is a functional relationship between the total number of HE-LTF symbols and the total number of space-time streams, noting that "[t]he total number of data streams **can allow the STA to know the number of LTFs** to be included in a UL data frame." '622 provisional at 5 (emphasis added).

1036. The '622 provisional also notes that the common information portion indicates the total number of data streams "of all STAs joining in the UL [transmissions]." '622 provisional at 7. Thus, the '622 provisional application indicates that the common information portion of the setup information may include an indication of the total number of space time streams to transmit in the responsible UL MU transmission, or it may identify the total number of HEW-LTFs for the responsive UL MU transmission, and this HEW-LTF information is related functionally to the total number of space time streams.

1037. Based on the foregoing citations and the additional figures and accompanying discussion shown on pages 8-10, it is my opinion that the '738 claims are supported by the '622 Provisional application. Specifically, the provisional application, like the '738 Patent specification, describes a downlink frame from an access point that is used to initiate

[redacted]

simultaneous uplink transmissions from multiple station devices. That downlink frame contains uplink setup information with a common information portion and a dedicated user-specific portion. The common information portion includes critical infrastructure information that relates functionally to the total number of space time streams that will be provided by the stations responding to the downlink frame, to thereby provide necessary information to synchronize and support both UL MU-MIMO transmissions as well as UL OFDMA transmissions.

1038. Claim 9 of the ’738 patent is similar to claim 1, except claim 9 is written from the perspective of a station rather than from the perspective of an access point. In similar fashion as the description above regarding claim 1, each of the limitations of Claim 9 also are supported by the ’622 provisional application.

11.2.11 ’738 Dependent claims

1039. Most of the dependent claims of the ’738 patent also are supported by the ’738 provisional application as I explain in this subsection.

1040. Claim 2 of the ’738 recites that the common information portion includes a length information associated with a length of the UL frames. This concept is disclosed on pages 5 and 7 of the ’622 provisional:

> The AP selects the STAs joining in the UL MIMO by using the above acquired information. Further, based on the selected result, the AP transmits a UL setup packet including information for transmission of each STA and starts the UL-MIMO transmission.
>
> - UL setup packet
>   - Total number of HEW-LTFs to be used for UL MU-MIMO
>   - Total number of OFDM symbols or length
>   - STA information
>   - STA Address (to be participated in UL-MU)
>   - used HEW-LTF rows to be used by each STA (toggle 형태?)
>   - # of streams to be transmitted by the corresponding STA
>   - MCS to be used by the corresponding STA
>   - transmission power information of by the corresponding STA

’622 provisional page 5.

[redacted]

UL setup frame (AP → STA)	Common information	The total number of data streams of all STAs joining in the UL
		A transmission length of a UL data frame (the number of OFDM symbols or a transmission time)

’622 provisional page 7. These excerpts illustrate that the uplink length information is included in the common information portion of the uplink setup information in the ’622 provisional, consistent with claim 2.

1041. Claim 3 depends on claim 2 and recites that the lengths of the UL MU frames are identical. Claim 4 depends on claim 3 and requires that padding bits are used when the transmission length is longer than the frame length to be transmitted. The 622 provisional on page 5 describes adding bits with a “0” value if the data length is shorter than the transmission length. Similarly on page 6, the ’622 provisional notes that the STAs start the UL MU-MIMO transmission “after padding in accordance with the total number of OFDM symbols included in the UL setup.”

1042. Claim 5 of the ’738 patent specifies required subfields of the dedicated information portion, including (i) station ID information; (ii) the number of data streams for each station, and the MCS for each station. The ’622 provision describes each of these parameters as forming art of the dedicated user portion of the uplink setup information. For example, the Table on page 7 of the ’622 provisional specifies the claimed parameters as forming part of the dedicated information of the uplink setup frame:

[redacted]

UL setup frame (AP → STA)	Common information	The total number of data streams of all STAs joining in the UL
		A transmission length of a UL data frame (the number of OFDM symbols or a transmission time)
	Dedicated information	An address of the corresponding STA
		The number of data streams to be used by the corresponding STA
		The LTF set to be used by the corresponding STA
		A transmission power of the corresponding STA
		A transmission MCS of the corresponding STA
		Beam information for the corresponding STA (compressed beam)

’622 provisional at 7. *See also* page 5:

- UL setup packet
  - Total number of HEW-LTFs to be used for UL MU-MIMO
  - Total number of OFDM symbols or length
  - STA information
    - STA Address (to be participated in UL-MU)
    - used HEW-LTF rows to be used by each STA (toggle 형태?)
    - # of streams to be transmitted by the corresponding STA
    - MCS to be used by the corresponding STA
    - transmission power information of by the corresponding STA

1043. Claim 6 requires that the acknowledgement frame includes information for one or more of the plurality of stations. This information is disclosed in the ’622 provisional for the reasons identified relative to Limitation 1f, which is incorporated herein by reference.

1044. Claim 8 specifies that the UL MU transmission from the plurality of stations is implemented as UL MU-MIMO. The ’622 provisional repeatedly recites that the UL MU-MIMO transmission is an UL MU-MIMO transmission. Some of those passages are cited in ’738 Limitations 1a and 1c, which are incorporated herein by reference. *See* ’622 provisional at 1 (Summary, Background); 2 (Objective, Detailed Description); 3

[redacted]

(preparation procedures); 4 (figure and description); 5 (description of AP transmitting UL setup packet to start UL MIMO transmission from multiple STAs); 6 (STAs start UL MU-MIMO transmission in accordance with UL setup information); 7 (Table describing frame exchanges to implement UL MU-MIMO transmission).

11.3 ’738 Prosecution History

1045. The ’738 Patent application was filed April 3, 2015 as Application No. 14/678,724 with the priority claims identified in the previous section. The application was filed in the Korean language. A verified English translated version of the original application was subsequently filed with the US patent & Trademark office.

1046. Prior to the examination of the application, a Preliminary Amendment was filed on February 17, 2016. This Preliminary Amendment cancelled the originally filed claims (claims 1-20) and introduced new claims 21-38. ’738 PH at 174/383. The original claims, which were cancelled in this Preliminary Amendment, had been directed generally to transmitting data with a plurality of traffic identifiers (TIDs) and receiving an ACK frame for at least some of that data, with the ACK frame including information fields that identify a TID and a block ACK bitmap. The new claims presented in the Preliminary Amendment, conversely, were directed to the technique by which UL MU transmissions are initiated (referred to as uplink setup information) and the content of that uplink setup information.

1047. On September 23, 2016, the Patent & Trademark Office issued its First Office. All claims of the pending application were rejected initially by the patent examiner. The examiner objected to certain phrases in the application claims 24, 27 and 36. 738 PH at 189/383 Additionally, claims 21-29 and 30-38 were rejected under 35 USC §112, 2nd paragraph because the Examiner contended the phrases “an information to be used for uplink multi-user transmission”, “an information being common to all of the plurality of stations”, and “an information being specific to each of the plurality of stations” were unclear. The Examiner additionally raised issues with the phrase “one or more stations.”

[redacted]

1048. Relative to the prior art, the examiner initially rejected claims 21, 25-27, 29-30, 34-36 and 38 as anticipated by Merlin US20150063258. The examiner also rejected claims 22-24, 28, 31-33 and 37 as obvious in light of Merlin 258 in view of Zhang (US Patent No 8,571,010). The Examiner also entered a non-statutory double patenting rejections. The first such double patenting rejection was made relative to Newracom's 9,455,773 patent, in view of Merlin for claims 21, 25-27, 29-30, 34-36 and 38. The second double patenting rejection was made relative to Newracom's co-pending Application 14/453419 in view of Zhang for claims 22-24, 28, 31-33 and 37.

1049. In response to the First Office Action, Newracom submitted an Amendment and Request for Reconsideration on December 22, 2016. '738 PH at 254/383. The claims were amended to address the Examiner's objections to the claim language. Additionally, the independent claims 21 and 30 were amended while claims 27 and 36 were cancelled. The amendment required transmitting a single physical downlink frame with downlink data and the uplink setup information to a plurality of stations. Claims 39 and 40 were newly added.

1050. On March 4, 2017, the Examiner entered a Final Rejection. The Examiner withdrew the prior rejections, but made a new rejection under 35 USC §103 based on Merlin in view of Yuan (US 20150029996). '738 PH at 271-72. The Yuan 996 published application was referenced by the Examiner with regard to its disclosure of preparing downlink data on a physical resource block of a subframe.

1051. Newracom submitted a Response After Final on June 15, 2017. '738 PH at 325/383. The amendment added the last limitation of the independent claims related to the requirement that the second information in the common information portion "is a function of a total number of space time streams to be used to transmit the multiple uplink frames":

[redacted]

> 21. (Currently amended) A method of operating an access point in a wireless communication network, the method comprising:
>
> generating downlink data;
>
> generating uplink setup information, the uplink setup information including a first information to be used for uplink multi-user transmission;
>
> transmitting the downlink data and the uplink setup information in a single physical downlink frame to a plurality of stations;
>
> simultaneously receiving multiple uplink frames from multiple stations of the plurality of stations; and
>
> transmitting an acknowledgement frame to the multiple stations after a successful reception of the multiple uplink frames,
>
> wherein the uplink setup information includes a common information portion and a dedicated information portion, the common information portion includes a second information being common to all of the plurality of stations to receive the uplink setup information, and the dedicated information portion includes [[a]]respective third information ~~being~~ specific to each of the plurality of stations to receive the uplink setup information, and
>
> wherein the second information is a function of a total number of space time streams to be used to transmit the multiple uplink frames.

’738 PH at 325/383.

1052. Newracom presented the following discussion of why this amendment distinguished over the combination of Merlin and Yuan, noting that Merlin did not disclose information related to the total number of space time streams. Merlin’s information related to space time streams was instead located in a user-specific information portion and only identified the space time streams for an individual station:

[redacted]

> The Office Action relies on the disclosure in Merlin of an Nss field 934 in a user specific field of a CTX transmission to disclose the claimed second information that is a function of a total number of space time streams to be used to perform the multiple uplink frames. However, as might be expected of information incorporated in a user-specific field, ¶[0073] of Merlin discloses that the "number of spatial streams field (Nss) [934, erroneously labeled 935 in the specification of Merlin] … indicates the number of spatial streams a user terminal may use." When multiple uplink frames are being transmitted, the number of spatial streams that one terminal may use is **not** a function of a **total** number of spatial streams used to perform the multiple uplink frames.
>
> Furthermore, as noted above, the Nss field 934 of Merlin is in a user-specific portion of the CTX transmission intended for a single station, whereas the claims second information is included in a common information portion and is common to all of a plurality of stations.
>
> Therefore, reliance on the Nss field 934 of Merlin to disclose the second information that is in a common information field and that is a function of **total** number of spatial streams used to perform multiple uplink frames is improper, and the rejection claims 21 and 30 as unpatentable under §103 over Merlin in view of Yuan should be withdrawn.

'738 PH at 330-331.

1053. Newracom also explained that the Zhang 010 reference did not solve the deficiencies of Merlin and Yuan with regard to the newly added claim limitation:

> Zhang and the copending Application No. 14/453,419 do not remedy the deficiency of Merlin and Yuan.
>
> Zhang discloses transmitting information on a "total number of space-time streams available for uplink transmission," Zhang, col. 10, ll. 37-38, but does not disclose transmitting the information on a total number of spatial streams actually used to perform multiple uplink frames, as recited in the present claims. The number of stream used may be different (in particular, may be less) than the number of streams available.

'738 PH at 330. Thus, Zhang was distinguished because it did not identify information related to the total number of space time streams to be used in the UL MU transmission.

1054. In response, the US Patent & Trademark Office issued a Notice of Allowance on July 21, 2017, indicating the amended claims were patentable. '738 PH at 345, 349-351.

1055. Thus, in summary, during the course of the prosecution of the '738 patent application, the claims (as amended in a Preliminary Amendment) were initially rejected

[redacted]

based on the Merlin ’258 published application. ’738 PH at 192. Other claims were found to have been obvious based on the combination of Merlin ’258 and Zhang (’010). *Id*. at 202. In addition, the claims were rejected for obviousness type double patenting based on Newracom’s own patents/applications in view of Merlin 258 (which disclosed transmitting an ACK frame to the multiple stations) and Zhang ’010 (as to some claims). ’738 PH at 208-238. In response to claim amendments to the ’738 application claims, the Office modified its rejection to reference the combination of Merlin 258 and Yuan 996. ’738 PH at 272. A subsequent amendment ultimately was found by the examiner to patentably distinguish over the combination of Merlin 258, Zhang 010 and Yuan 996. Thus, these 3 references were considered in detail (alone and in combination) by the US Patent & Trademark Office during the course of the ’738 prosecution

1056. In addition to addressing Merlin ’258, Zhang ’010 and Yuan 996, the prosecution also identified submissions authored by Merlin (and Zhang) related to Trigger Frame formats. The Merlin submission was 15/0877r0 submitted July 13, 2015, which is after the Newracom provisional filing in April 2014.

1057. In its invalidity case, TP-Link alleges that Merlin 258, Yuan 996 and Zhang 010 anticipate the ’738 Claims and that in combination they render obvious the ’738 claims. That is an issue that the patent examiner already addressed and concluded did not render the ’738 claims unpatentable.

11.4 Overview of Alleged ‘738 Prior Art

1058. Dr. Hansen analyzes eight references in connection with the ‘738 Patent: (1) U.S. Patent Publication 2015/0063258 to Merlin (“Merlin 258”, Hansen Ex. 738-2); (2) U.S. Patent Publication 2015/0029996 to Yuan (“Yuan”, Hansen Ex. 738-3); (3) U.S. patent No. 8,571,010 to Zhang (“Zhang”, Hansen Ex. 738-4); (4) U.S. Patent Publication 2015/0124690 to Merlin (“Merlin 690”, Hansen Ex. 738-5); (5) U.S. Patent Publication 2015/0023335 to Vermani (“Vermani”), Hansen Ex. 513-6); (6) U.S. patent No. 9,825,678 to Chu (“Chu”), Hansen Ex. 738-7; (7) U.S. Patent No. 9,794,032 to Kang (“Kang”),

[redacted]

Hansen Ex. 738-8; and (8) U.S. Patent Publication 2012/0026928 to Gong ("Gong"), Hansen Ex. 738-9. Hansen Report at ¶¶1867. I provide an overview of each below.

11.4.1 Merlin '258

1059. Merlin '258 describes a system in which an AP includes multiple antennas for exchanging downlink and uplink transmissions with station devices. [0035], [0037]. Merlin '258 indicates that the disclosure supports transmitting an uplink signal from multiple user terminals (UTs) to an AP. [0051]

1060. Merlin '258 describes multiple user uplink transmissions in response to a CTX message. [0053] As shown in Figure 4 of Merlin's '258 published application, an AP 110 may transmit a clear to transmit (CTX) message 402 to user terminals (UT) 120 indicating which STAs may participate in the UL MU-MIMO scheme, such that a particular UT knows to start an UL MU MIMO transmission. [0053].

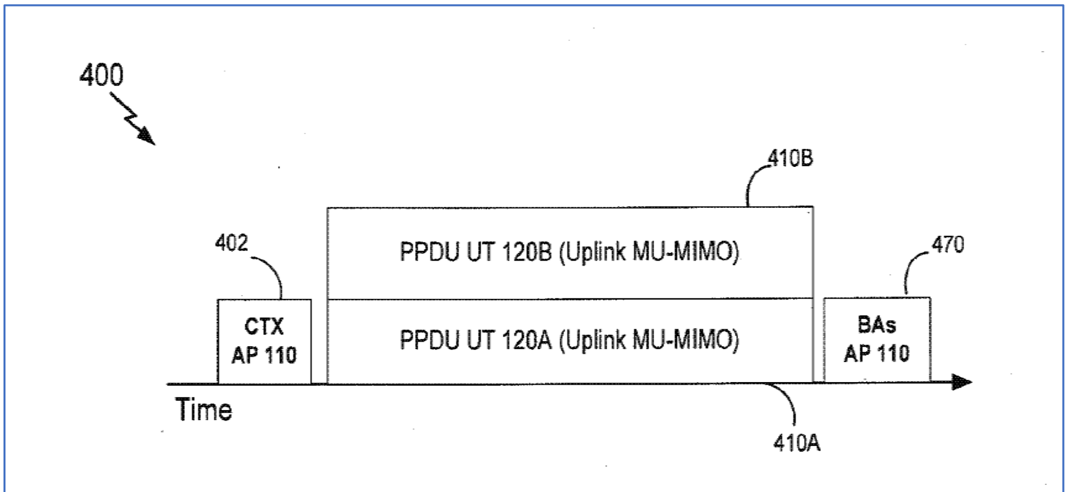


FIG. 4

1061. Merlin indicates a CTRL field 920 in a CTX frame 900 may indicate if the frame is being used for UL MU MIMO or UL FDMA, indicating whether a Nss or Tone allocation field is present in the UT field 930. [0073]

[redacted]

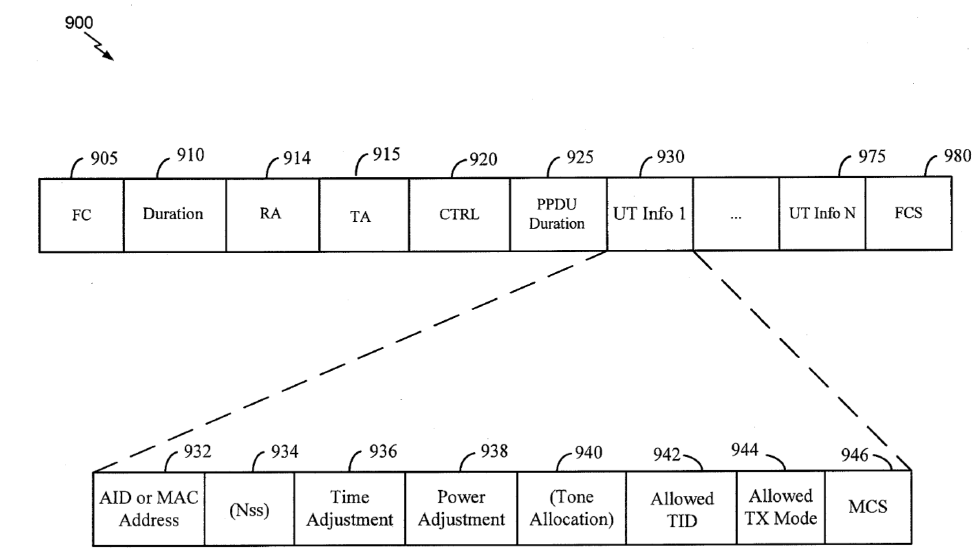


FIG. 9

’258 at Figure 9.

1062. Merlin discloses including a field for the number of spatial streams (Nss) as shown in Figure 9, but that field is specific to a particular user terminal (UT) and is part of a UT Info field. *Id.* Thus, and as the Patent & Trademark Office determined, while Merlin 258 includes relevant disclosure regarding using a CTX frame to initiate UL MU frames, it does not disclose the ’738 independent claims, all of which require that a common information portion of the uplink setup information includes information that is a function of a total number of space time streams to be used to transmit the multiple uplink frames. In addition, there are other aspects of the ’738 claims that are not disclosed in the Merlin ’258 published application, as explained below.

11.4.2 Yuan

1063. Yuan is a published US patent application (US 2015/0029996) (“Yuan or Yuan 996). As its title indicates, it is related to downlink control channel multiplexing for cellular communications. Yuan at [0001], [0002]. More specifically, Yuan relates to the 3GGP cellular standard, rather than the 802.11 standard that is the focus of the ’738 patent. Compare Yuan at [0003] and ’738 patent at 1:23-42. While cellular communications (and

[redacted]

the 3GPP standard) and Wi-Fi communications (and the 802.11 standard) both generally involve wireless communications, the problems and issues related to these technologies differs substantially. It is not fair to conclude, as Dr. Hansen suggests, that a skilled artisan would necessarily be motivated to combine the teachings of Yuan with 802.11 references. If that were the case, then the two standards would be much more similar than they are. Specific to the problem of implementing UL MU transmissions from different user devices (STAs) in 802.11, which is a primary focus of the '738 patent, there was no mechanism available to coordinate the simultaneous responses from a plurality of disparate station devices in prior versions of 802.11. Wi-Fi systems have been designed to mostly operate in a distributed fashion, and thus 802.11 has employed a collision avoidance mechanism to provide media access control. In contrast, cellular systems have been designed to operate in a centralized fashion, and a centralized scheduler running in a base station coordinates simultaneous UL responses from a plurality of disparate user devices.

1064. According to Yuan, physical DL control channel (PDCCH) which carries control data, is time multiplexed with Physical DL Shared Channel (PDSCH) which carries downlink data. [0003]. The physical control channel usually occupies the entire first few OFDM symbols, spanning the entire system bandwidth to allow earlier decoding of DL/UL grants. [0003]

1065. The Yuan published application is primarily concerned with resource multiplexing between the physical downlink control channel and the physical downlink data channel. Yuan at [0006]. Figure 1 shows 5 different users (User 1 to 5) that are being scheduled. [0014]. Each subframe contains 2 slots. The resource region not belonging to the legacy Physical Downlink Control Channel (PDCCH) is shown in dark gray, while the light gray shows the enhanced physical downlink control channel (ePDCCH) transmission.

[redacted]

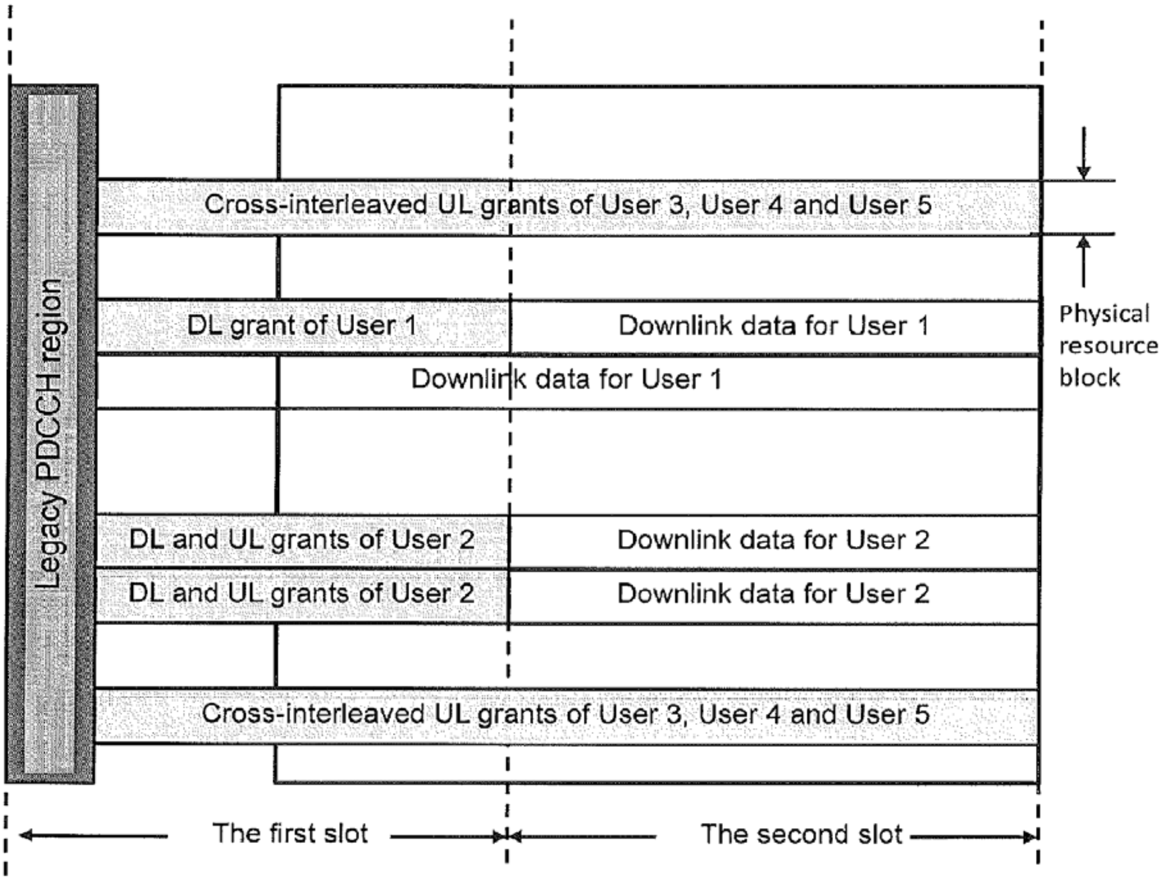


Figure 1

In this figure, User 1 has only a DL grant, with the 1st slot of the resource block providing the DL grant and the 2nd slot is used for User 1's downlink data transmission. The adjacent resource block also is used to for the downlink data transmission. The DL and UL grant of User 2 is mixed in the 1st slot of 2 adjacent resource blocks. The DL data for User 2 is transmitted in the 2nd slot of 2 adjacent resource blocks. UL grants of Users 3, 5 and 5 are cross-interleaved, and mapped to the 1st and 2nd slots of two non-adjacent resource blocks, which are frequency distributed.

1066. As Figure 1 of Yuan illustrates, the transmission of user specific grant information may occur in different time slots at different times, and the same is true of the downlink data. For example, the UL grant of Users 3, 4 and 5 occurs in multiple non-adjacent

[redacted]

resource blocks and in both slots 1 and 2, whereas the grant for User 1 only occurs in a single resource unit and in the 1st time slot. The grant to user 2 occurs in multiple adjacent resource units, but also only in the 1st slot. The downlink data for user 1 spans 2 resource elements, and relative to the second resource unit, spans both the 1st slot and the 2nd slot. There is no downlink data for Users 3, 4, and 5, which have their grants interleaved across the entire resource element.

1067. There is no indication that the UL grant solicits an uplink multi-user frame. The uplink transmission that results from the uplink grant is not identified. While Yuan discusses DL and UL grants, Yuan only shows the transmissions of downlink data. Yuan is completely silent on any UL MU transmission from multiple user devices, and thus Yuan does not indicate that the UL grants will solicit a simultaneous UL MU response from a plurality of station devices. Further, the detail of what the content is of the DL and UL grant transmissions is not provided in Yuan.

11.4.3 Zhang

1068. Zhang describes a synchronization data unit that is transmitted to a plurality of devices, with the synchronization data unit specifying a space-time mapping parameter. A plurality of data units are transmitted simultaneously from some of the plurality of devices in accordance with the space-time mapping parameter. Zhang at 1:60-67.

1069. The Detailed Description in Zhang indicates that an AP receives simultaneous UL transmission frames from several client stations via an antenna array. 3:31-36. To implement this, the AP schedules a protected time period for use by the STAs, provides information to the clients that support this functionality, receives in parallel several frames of the same or different duration, and acknowledges receipt of the frames in a single ACK or in station-specific frames. 3:36-43.

1070. The timing of the synchronization data unit (SUT) is depicted in Figures 4A-4C of Zhang:

[redacted]

FIG. 4A

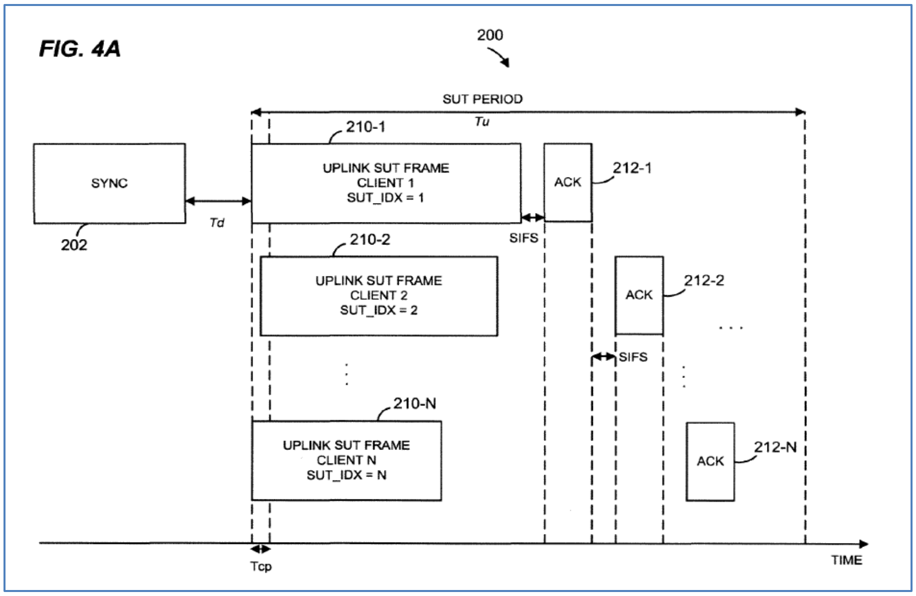
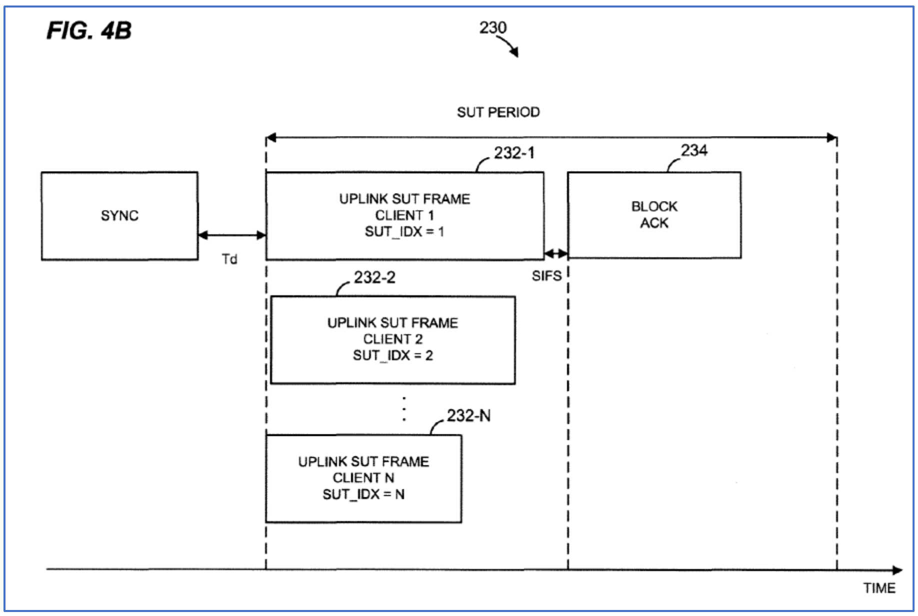
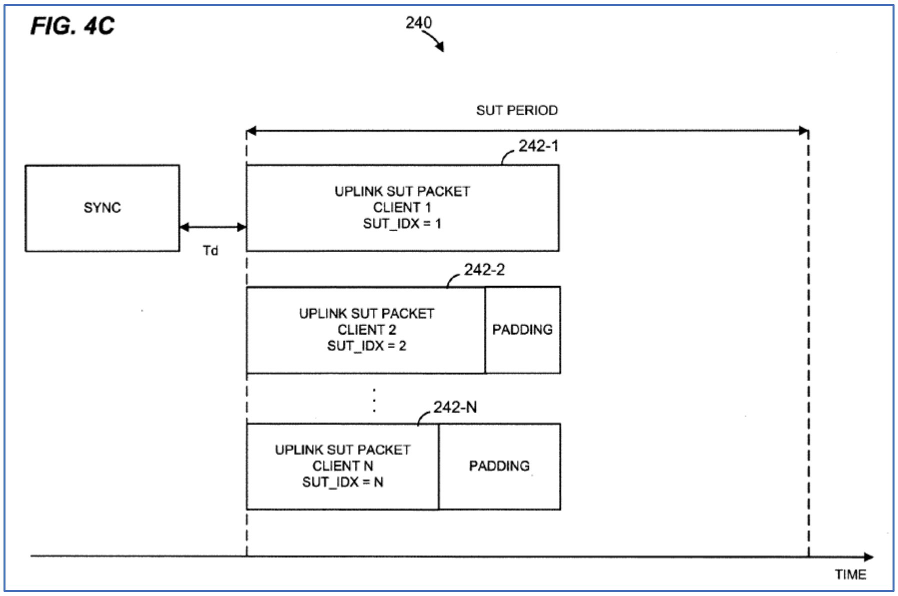


FIG. 4B



[redacted]



1071. According to the Zhang specification, the AP also controls (i) the power at which stations transmit SUT frames during the protected time period, (ii) the maximum duration of an SUT frame, (iii) the amount of bandwidth allocated to each station, etc., and/or one or more of (iv) assigns unique indexes to stations, (v) generates modulation and coding scheme (MCS) parameters for each station, (vi) allocates spatial (or "space-time") streams to stations. Zhang at 3:43-51. With regard to the space-time stream indication, Zhang explains that the AT controls the number of space-time streams and allocates the space-time streams to individual SUT-capable STAs. 12:1-4. Note that Zhang does indicate that the AP may also provide the total number of space-time streams available for uplink transmission together with a listing of space-time streams allocated to each individual STA. Zhang '010 at 10:37-41; *see also* 14:15-18.

[redacted]

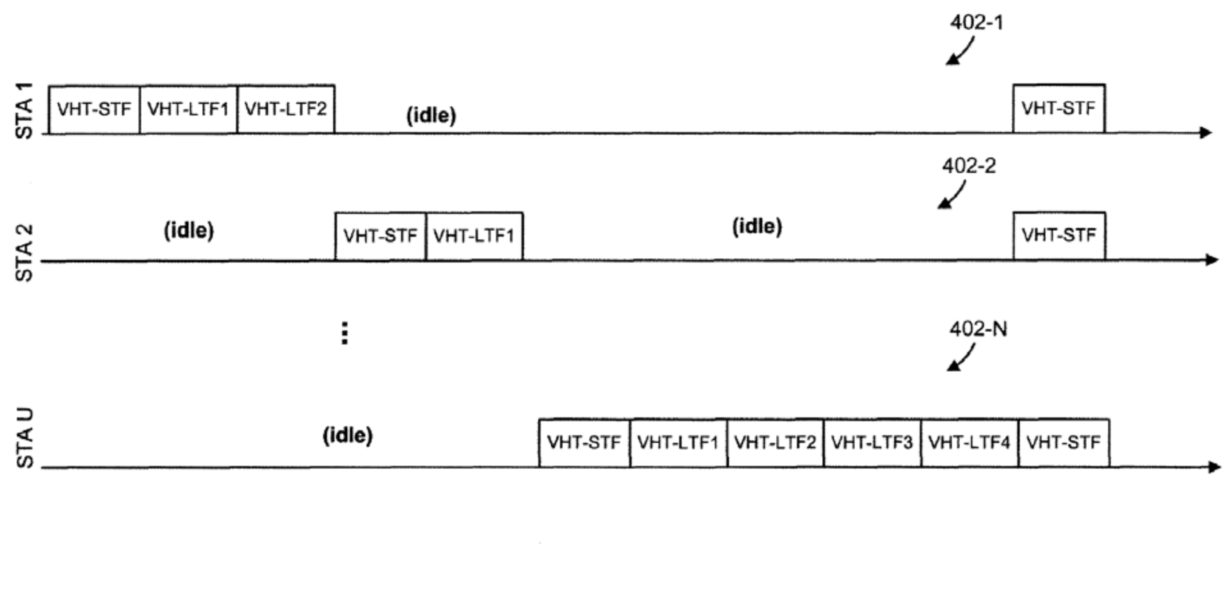


FIG. 6B

According to the Zhang patent, "each station transmits at least as many VHT-LTFs as space-time streams assigned to the station by the AP." 15:45-47. Thus, the number of VHT-LTFs is determined based on the number of space-time streams assigned to that particular station.

1072. The Zhang patent was considered during the prosecution of the '738 patent, together with Merlin 258 and Yuan. The Examiner allowed the '738 patent over those combination of references.

11.4.4 Merlin 690

1073. The Merlin '690 published application describes generating a multi-user packet that solicits an immediate acknowledgement response from a plurality of devices, including an ACK and a block ACK (BA). *See* Merlin 690 Abstract.

1074. The Merlin 609 published application describes multiple user uplink acknowledgement (ACK) transmissions. As one example, UL MU MIMO or FDMA may be used to transmit multiple Block Acknowledgements (BAs) at the same time. A Block Acknowledgement Request (BAR) frame is used to solicit multiple immediate acknowledgement responses. Merlin 690 at [0050].

[redacted]

1075. As I noted above, the Merlin 690 published application is not prior art to the 738 patent, which claims priority to April 4, 2024. The Merlin 690 published application was filed in October 2014, and published May 2015. Nonetheless, I will briefly address Merlin 690 relative to certain claim limitations.

11.4.5 Vermani

1076. Vermani describes a physical layer design for uplink multi-user MIMO transmissions. The transmissions include a packet with a preamble portion. The preamble includes a long training field (LTF); a first signal (SIG) field subsequent to the LTF; one or more other LTFs located subsequent to the first SIG field; and at least one second SIG field, wherein all SIG fields in the preamble portion, other than the first SIG field, are subsequent to the other LTFs. Vermani at Abstract; [0009]

1077. The Vermani Abstract also describes another embodiment in which transmissions include a packet having a preamble portion comprising tone-interleaved LTFs that have a frequency offset adjustment based on the tone-interleaved LTFs.

11.4.6 Chu

1078. Chu discloses a technique for selecting members of a client uplink group. An uplink group definition frame is transmitted to each member of the UL group, and it includes an uplink MU MIMO transmission schedule for the client uplink group members to trigger them to transmit simultaneously to an access point.

1079. As shown in Figure 5 of Chu, a DL sync signal is transmitted from the AP and the STAs respond with a UL MU MIMO transmission. The AP may then respond with a B-ACK:

[redacted]

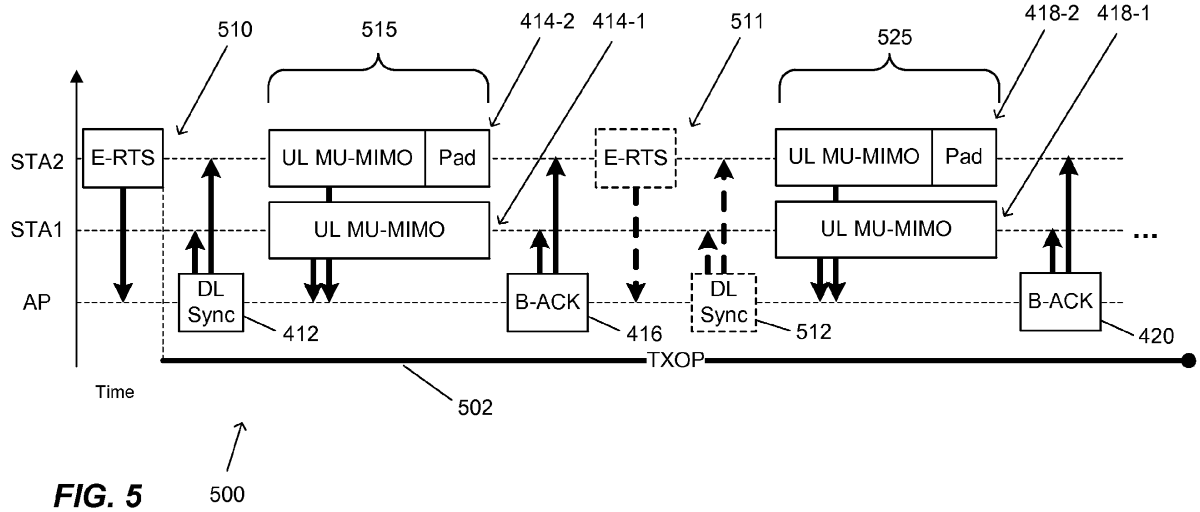


FIG. 5

1080. According to Chu, the STA sends a communication frame or management frame through an enhanced distributed channel access (EDCA) procedure. Chu at 6:2-10. The AP then transmits an uplink group definition frame through EDCA procedures or other medium access procedures. Chu at 6:15-17.

11.4.7 Kang

1081. Kang describes a wireless local area network in which an AP allocates a first transmission channel bandwidth to a first STA which is MIMO-paired with the AP, and allocates a second transmission channel bandwidth to a second STA that also is MIMO-paired to the AP. The AP transmits to the first and second STAs a sync trigger that

[redacted]

determines the time during which the first STA will transmit a first PPDU and the time when the second STA will transmit a PPDU. *See* Kang Abstract.

11.4.8 Gong

1082. Gong discloses in paragraph [0014] the format of a group action frame, which is shown in Figure 1.

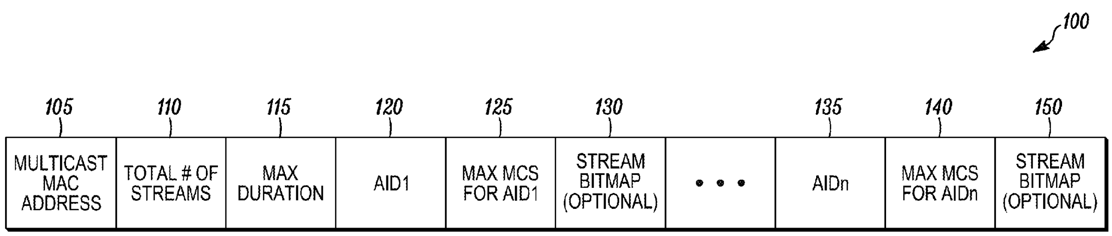


FIG. 1

1083. A responsive uplink frame is shown in Figure 2 and described in the subsequent paragraph, [0015].

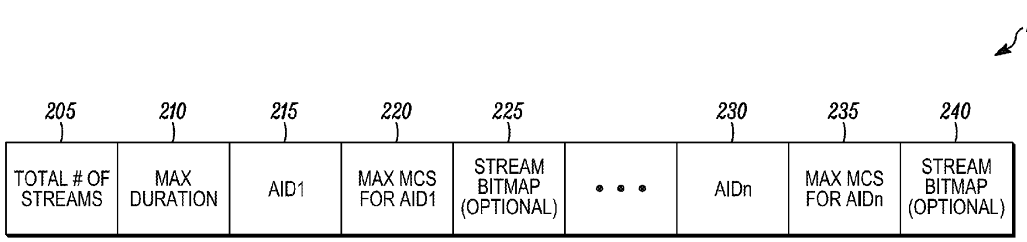


FIG. 2

11.5 Dr. Hansen's Alleged Prior Art Does Not Invalidate the Asserted '738 Claims

1084. In ¶1867, Dr. Hansen states that each asserted claim of the '738 Patent is obvious as follows:

[redacted]

> 1867. As shown below, the claimed methods of the '738 Patent were previously known in the art. Specifically, each asserted claim of the '738 Patent is obvious in view of U.S. Patent Publication 2015/0063258 ("Merlin 258") and/or U.S. Patent Publication 2015/0029996 ("Yuan") and/or U.S. Patent No. 8,571,010B ("Zhang") and/or U.S. Patent Publication 2015/0124690 ("Merlin 690") and/or U.S. Patent Publication 2015/0023335A1 ("Vermani") and/or U.S. Patent 9,825,678 ("Chu") and/or U.S. Patent to 9,794,032 ("Kang") and/or U.S. Patent Publication 2012/0026928 ("Gong").

Hansen Invalidity report at page 629.

1085. I disagree with Dr. Hansen's conclusion that the '738 claims would have been obvious.

1086. As an initial matter, many of these references upon which Dr. Hansen relies have not been shown to be prior art by Dr. Hansen. As I noted above, the '738 patent claims priority back to the '622 provisional application that was filed April 4, 2014. My discussion regarding the Priority for the '738 Patent confirms that Claim 1 of the '738 patent and most of the other '738 claims are described in the '622 provisional application with sufficient detail to enable a skilled artisan to conclude that the '738 inventors were in possession of the inventions described in the '738 claims by April 4, 2014.

1087. Many of the references on which Dr. Hansen relies for his invalidity challenge are dated after April 4, 2014, and Dr. Hansen has not established that these references would be entitled to an earlier date. These are the dates of the references upon which Dr. Hansen has failed to show to be prior art to the '738 patent:

1088. Merlin 258 was filed August 26, 2014 as Application No. 14/469,306 and was published March 5, 2015 as US 2015/0063258. The Merlin '258 is not prior art to the '738 application because the Merlin application was filed after the priority date of the '738

[redacted]

patent, which was April 4, 2014 based on the ’622 provisional. Merlin ’258 indicates it has a related provisional application (No. 61/871,269) but Dr. Hansen does not indicate or establish that the Merlin ’258 publication was disclosed or is enabled by that provisional application.

1089. Merlin ’690 was filed October 30, 2014 as Application No. 14/528,520 and was published May 7, 2015 as US 2015/0124690. The Merlin ’690 is not prior art to the ’738 application because the Merlin application was filed after the priority date of the ’738 patent, which was April 4, 2014 based on the ’622 provisional. Merlin ’690 indicates it has a related provisional application (No. 61/899,121) but Dr. Hansen does not indicate or establish that the Merlin ’690 publication was disclosed or is enabled by that provisional application.

1090. Vermani 335 was filed July 15, 2014 as Application No. 14/332,301 and was published January 22, 2015 as US 2015/0023335. The Vermani publication is not prior art to the ’738 application because it was filed after the priority date of the ’738 patent, which was April 4, 2014 based on the ’622 provisional. Vermani indicates it has related provisional applications, but Dr. Hansen does not indicate or establish that the Vermani publication was disclosed or is enabled by those provisional applications.

1091. Chu 678 was filed November 25, 2014 as Application No. 14/553,982 and was issued November 21, 2017 as US 9,825,678. Chu is not prior art to the ’738 application because the Chu application was filed after the priority date of the ’738 patent, which was April 4, 2014 based on the ’622 provisional. Chu indicates it has a related provisional application (No. 61/909,024) but Dr. Hansen does not indicate or establish that the Chu publication was disclosed or is enabled by that provisional application.

1092. In addition to the issues related to whether the references are prior art, several of these references were considered by the US Patent & Trademark Office during the prosecution of the ’738 patent. The patent examiner specifically considered Merlin 258, Yuan and Zhang, and allowed the ’738 claims over the combined teachings of these

[redacted]

references. Nonetheless, Dr. Hansen relies upon these same references for his invalidity analysis, including relying primarily upon the Merlin 258 reference that was front-and-center in the prosecution of the ’738 patent, as I noted above in the discussion of the ’738 Prosecution History. Dr. Hansen does not address the findings made by the US Patent & Trademark office relative to those 3 references.

1093. I also note that it is unclear from the Hansen Invalidity Report exactly how Dr. Hansen proposes to combine together the teachings of the various references he cites to arrive at his conclusion regarding obviousness. He individually addresses each of the different claim limitations, and then discusses serially the eight different references he cites, but there is minimal analysis of combining together the teachings of these references for that particular limitation. He ends the discussion of each reference within a limitation with a statement similar to the following phrase to indicate that if the reference does not disclose that claim limitation, it would still be obvious because of the background knowledge and ordinary creativity of a POSITA:

> 1874. Alternatively, Merlin 258, in view of the background knowledge and ordinary creativity of a POSITA at the time of the invention, renders this element obvious.

Hansen Invalidity Report at ¶1874.

1094. Relative to each limitation, Dr. Hansen states that if any reference doesn’t disclose that claim element, it would have been obvious in view of an unnamed combination of the 8 references:

[redacted]

> 2170. To the extent it is argued or determined that any of the above references do not disclose this element, then this element would have been obvious at the time of the invention in view of any combination of Merlin 258, Yuan, Zhang, Merlin 690, Vermani, Chu, Kang, and/or Gong. *See* "Motivation to Combine," *infra*.

Hansen Invalidity Report at ¶2170.

1095. Dr. Hansen includes a motivation to combine section where he states that it would have been obvious to combine the teachings of any combination of the 8 references. *See* Hansen Report at ¶2392. He then provides the following exemplary combinations:

- Merlin 258 with either or both of Yuan or Merlin 690 (¶2393)
- Merlin 258 with either or both of Chu or Kang (¶2395)
- Merlin 258 with either or both of Zhang or Vermani (¶2396)
- Merlin 258 with either or both of Chu or Gong (¶2398)
- Merlin 258 with any combination of Yuan and/or merlin 690 and/or Zhang and/or Vermani (¶2399)
- Chu with Kang and/or Gong (¶2400)
- Merlin 258 and/or Chu with any combination of Yuan and/or Zhang and/or Merlin 690 and/or Vermani and/or Kang and/or Gong (¶2401)

1096. I will address each of these exemplary combinations, but there is little or no analysis provided by Dr. Hansen with regard to these combinations, or the specific concepts that he contends it would have been obvious to combine. There is no clear recitation in these exemplary combinations regarding the specific modifications that would be made to the primary reference (*e.g.*, Merlin 258 or Chu) and the specific concepts that would be substituted or added from the secondary reference(s) to the primary reference. Nor does he explain why it would have been obvious to combine the teachings that he proposes making in any sort of detail beyond the general notion that any or all of the references are analogous and could be combined together. There is nothing within Dr. Hansen's Report where he

[redacted]

specifically identifies a particular modification or addition to a primary reference and he explains why it would have been obvious to make this change. In my opinion, there is not sufficient detail in Dr. Hansen's proposed combinations to clearly show that the '738 claims would have been obvious in April 2014 when the '738 invention was disclosed in the '622 provisional application.

1097. To the extent that Dr. Hansen provides further clarity regarding his proposed combinations, I reserve the right to supplement this Report to address any clarification that he provides.

1098. In the subsequent sections, I will address each of the references individually at first and then will address the proposed combinations of references identified in Dr. Hansen's report.

11.5.1 Merlin '258 Fails To Disclose Or Render Obvious Several '738 Claim Limitations

1099. The Newracom '738 Patent was filed on April 3, 2015. It claims priority to Provisional application No. 61/981,427 filed April 18, 2014 and Provisional application No. 61/975,622 filed April 4, 2014. Both of these provisional applications were incorporated by reference into the '738 patent. '738 patent at 1:7-11. As I explained above, the April 4, 2014 provisional application provides adequate written description support for the independent claims of the '738 patent.

1100. During the course of the prosecution of the '738 patent application, many of the initial claims (after the Preliminary Amendment) were rejected based on Merlin '258. '738 PH at 192. Other claims were found to have been obvious based on the combination of Merlin '258 and Zhang ('010). *Id.* at 202. In addition, the claims were rejected for obviousness type double patenting based on US Patent No. 9,455,773 in view of Merlin 258 and Zhang (as to some claims). '738 PH at 208-238. In response to claim amendments to the '738 application to distinguish Merlin, the Office modified its rejection to focus on the combination of Merlin and Yuan. '738 PH at 272.

[redacted]

1101. In response to the new rejection, the applicant Newracom amended the independent claims to add the last limitation, which require that the second information (that forms part of the common information portion) is a function of a total number of space time streams to be used to transmit the multiple uplink frames. ’738 PH at 325, 327. The patent examiner withdrew his rejections and allowed the claims after this amendment. ’738 PH at 349-351.

1102. As the above discussion of the ’738 prosecution illustrates, Merlin ’258 was fully consider by the patent examiner during the prosecution of the ’738 patent, and the claims of the ’738 patent were allowed over the Merlin publication and the Merlin provisional application. The Merlin ’258 publication relies on a provisional application, No. 61/871,269. Dr. Hansen, however, does not mention or refer to this provisional application. As a result, I will not address that provisional application since it forms no part of the Hansen Invalidity report, although I reserve the right to do so in the event that Dr. Hansen revises or supplements his report.

1103. Merlin ’258 describes multiple user uplink transmissions in response to a CTX message. [0053] As shown in Figure 4 of Merlin’s ’258 published application, an AP 110 may transmit a clear to transmit (CTX) message 402 to user terminals (UT) 120 indicating which STAs may participate in the UL MU-MIMO scheme, such that a particular UT knows to start an UL MU MIMO transmission. [0053].

[redacted]

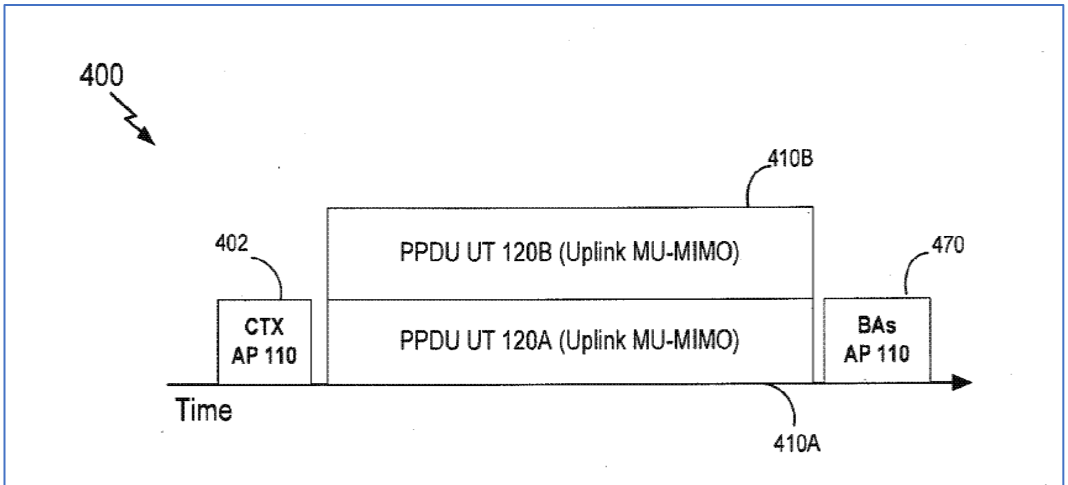


FIG. 4

1104. Merlin indicates a CTRL field 920 in a CTX frame 900 may indicate if the frame is being used for UL MU MIMO or UL FDMA, indicating whether a Nss or Tone allocation field is present in the UT field 930. [0073]

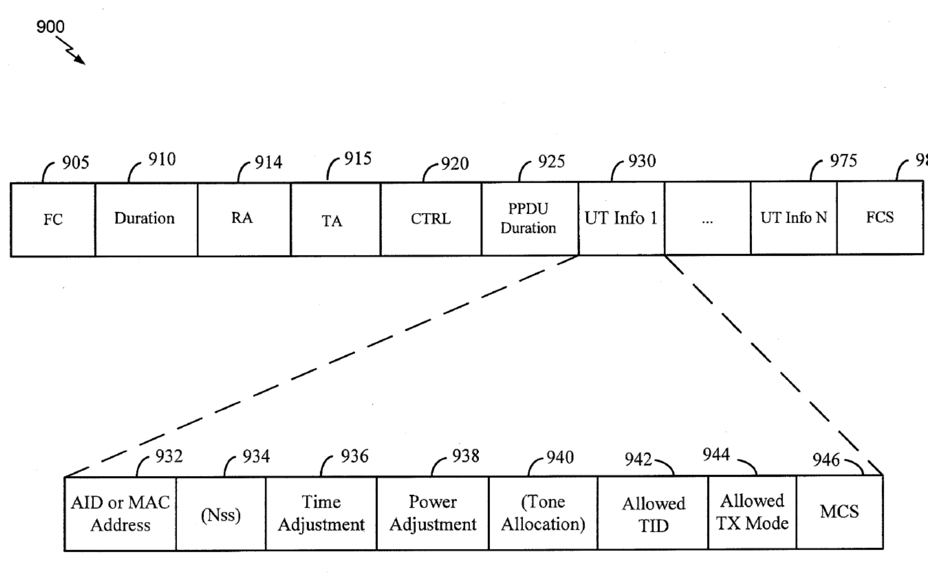


FIG. 9

’258 at Figure 9.

1105. Merlin discloses including a field for the number of spatial streams (Nss) as shown in Figure 9, but that field is specific to a particular user terminal (UT) and is part of a UT

[redacted]

Info field. *Id.* As the Patent & Trademark Office determined, while Merlin 258 includes relevant disclosure regarding using a CTX frame to initiate UL MU frames, it does not disclose the ’738 independent claims, all of which require that a common information portion of the uplink setup information includes information that is a function of a total number of space time streams to be used to transmit the multiple uplink frames. In addition, there are other aspects of the ’738 claims that are not disclosed in the Merlin ’258 published application, as explained below.

1106. Dr. Hansen has not shown that Merlin ’258 discloses at least limitations 1d and 1j of independent Claim 1 of the ’738 patent, as I will explain below.

11.5.1.1 Limitation 1d: transmitting downlink data and uplink setup information in a single physical downlink frame to a plurality of stations

1107. Claim 1 of the ‘738 Patent requires generating downlink data in Limitation 1b and then, relative to Limitation 1d, transmitting the downlink data together with uplink setup information. Dr. Hansen states that Merlin ‘258 teaches Limitation 1d. Hansen Report at ¶2004. I disagree.

1108. While an access point certainly can generate downlink data, Dr. Hansen does not identify any disclosure in Merlin 258 that would indicate that downlink data of any sort is included as part of the CTX frame that is transmitted to the user terminals.

1109. Relative to the uplink setup information (Limitation 1c), Dr. Hansen refers to the clear to transmit message CTX 402, which indicates the users that are to participate in the UL U-MIMO scheme. Hansen at ¶ 1970. According to Dr. Hansen, the CTX message may be transmitted in a payload portion of a PPDU, as shown in Figure 10. Hansen at ¶ 1970. According to Dr. Hansen, Figure 9 shows an example of a CTX format. Hansen at ¶1971 (citing [0073]). For the downlink data (Limitation 1b), Dr. Hansen points to Figure 2 of Merlin, which shows an access point 110 and user terminals 120m and 120x in MIMO system 100. Dr. Hansen at ¶1930.

[redacted]

1110. For Limitation 1d, Dr. Hansen refers to the time sequence diagram of Merlin Figure 4:

> 2004. Merlin 258 at ¶ [0053] "FIG. 4 is a time sequence diagram 400 showing an example of an UL-MU-MIMO protocol 400 that may be used for UL communications. As shown in FIG. 4, in conjunction with FIG. 1, the AP 110 may transmit a clear to transmit (CTX) message 402 to the user terminals 120 indicating which user terminals 120 may participate in the UL-MU-MIMO scheme, such that a particular UT 120 knows to start an UL-MU-MIMO transmission. In some embodiments, the CTX message may be transmitted in a payload portion of a physical layer convergence protocol (PLCP) protocol data units (PPDUs). An example of a CTX frame structure is described more fully below with reference to FIG. 10."

Hansen at ¶2004, quoting [0053] of Merlin 258.

1111. Merlin 258 Figure 4 is shown below:

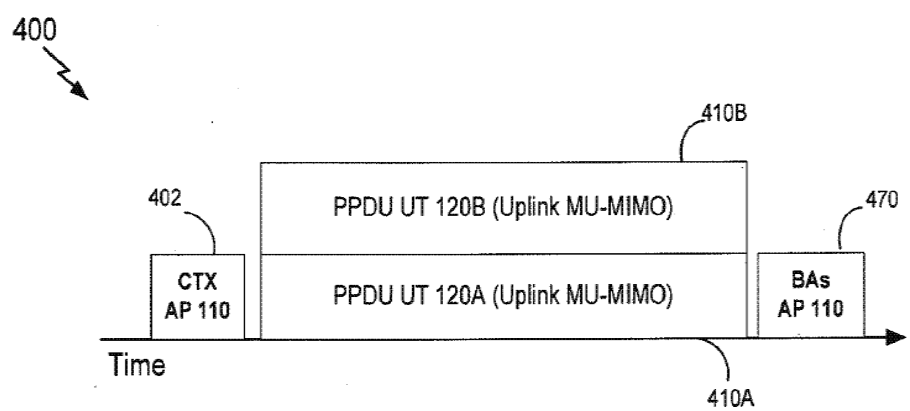


FIG. 4

[redacted]

1112. There is no indication of downlink data in the CTX message 402 transmitted by the AP as shown in Figure 4. While paragraph [0053] indicates that the CTX may, in some embodiments, be sent in a payload portion of a PPDU, there is nothing that Dr. Hansen refers to as comprising downlink data in that PPDU, nor does Merlin '258 provide further detail regarding other downlink data that would be included in a CTX PPDU. Paragraph [0053] only mentions the CTX message as being included in the PPDU, and does not identify any other data of any type that would also form part of that PPDU transmission of the CTX message.

1113. Dr. Hansen does not identify, and I have not seen in Merlin '258 any description of what information would be included with the CTX message that is sent from the AP to the UTs, other than the information described in [0073] and shown in Figure 9 of Merlin '258. Nor does Dr. Hansen identify any portions of the CTX information provided in Merlin Figure 9 as constituting downlink data. Thus, Dr. Hansen has not identified any downlink data that is sent with the CTX message in Hansen. Further, my review of Figure 9 indicates that the information provided in Figure 9 would correlate only to uplink setup information without any identification of additional downlink data.

1114. Thus, while Merlin discloses sending a Clear to Transmit (CTX) frame, it is not apparent that this frame discloses transmitting downlink data and uplink setup information in a single downlink frame.

1115. This same issue was raised in the prosecution of the '738 patent. Newracom contended that neither Merlin (nor Zhang) disclosed transmitting uplink setup information in a physical downlink frame that also included download data. '738 PH at 257, 261. As noted in the Amendment filed in the '738 PH, the claims were amended to recite "transmitting the uplink setup information on the physical downlink frame together with other (downlink) data." Newracom noted that unlike Merlin, "according to claim 21 [which issued as Claim 1], there is the physical downlink frame for transmitting the downlink data that are not the uplink setup information, and the uplink setup information is piggybacked

[redacted]

on that physical downlink frame." PH at 263. In response to this amendment in the '738 prosecution, the examiner acknowledged that "Merlin does not explicitly disclose generating downlink data and transmitting the downlink data and the uplink setup information in a single physical downlink frame to a plurality of stations.". PH at 275.

1116. For these reasons, it is my opinion that Merlin '258 does not teach or suggest Limitation 1d.

11.5.1.2 Limitation 1g: wherein the uplink setup information includes a common information portion and a dedicated information portion

1117. Claim 1 of the 738 patent requires that the uplink setup information is configured to include a common information portion and a dedicated information portion. Thus Claim 1 requires that the single physical downlink frame includes a specific organization, defining a common information portion and a dedicated user portion. Limitation 1g (together with Limitations 1h and 1i) capture that organization.

1118. Dr. Hansen states that Merlin 258 teaches Limitations 1g and 1h. Hansen Report at ¶2098-2104. I disagree. Hansen fails to identify or explain how Merlin 258 meets this specific organization recited in these claim limitations.

1119. While the excerpts from the Merlin 258 publication identify various parameters that are transmitted by an AP as part of the CTX message in Figure 9, there is nothing in Merlin that indicates a discrete information portion defining a common field. The block quotes from Merlin 258 do not clearly establish the sort of organization of common information that Claim 1 requires in limitations 1g and h. Further, Dr. Hansen does not explain how these parameters from Merlin would have been organized to define this common information portion consistent with Limitations 1g and 1h.

[redacted]

11.5.1.3 Limitation 1j: wherein the second information is a function of the total number of space-time streams to be used to transmit the multiple uplink frames

1120. Limitation 1j recites, in combination with 1g and 1h: "wherein the uplink setup information includes a common information portion …, the common information portion includes a second information being common to all of the plurality of stations to receive the uplink setup information, … and wherein the second information is a function of a total number of space time streams to be used to transmit the multiple uplink frames."

1121. As I noted in the Prosecution History section, Limitation 1j was added specifically to distinguish the Merlin 258 published application, and the patent examiner agreed that Merlin did not teach of suggest this limitation.

1122. Despite this history and the conclusion reached by the patent examiner, Dr. Hansen states that Merlin '258 teaches Limitation j. Hansen Report at ¶¶2130-2135. I disagree that Merlin 258 discloses that the common portion of an uplink setup information frame includes information that is a function of the total number of space time streams to be used in the UL MU transmission by the plurality of stations.

1123. Dr. Hansen begins his discussion of this limitation by noting that the teachings of the August 28, 2013 provisional were incorporated into the '258 published application. Hansen at ¶2131. Notably, once again, Dr. Hansen does not suggest that the Merlin '258 published application is entitled to the priority date of August 28, 2013. Nor does he cite any information from the provisional application.

1124. Dr. Hansen refers to the system architecture generally discussed in Merlin 258 at [0035], *see* Hansen at ¶2132, but this does not provide any detail whatsoever regarding including information functionally related to the total number of space time streams in a common information portion of an uplink setup information transmission. Instead, paragraph [0035] addresses the number of antenna (N_{ap}) that an access point has, the number (K) of selected user terminals, and the number of antennas that a user terminal has (N_u). But it is completely silent with regard to identifying information in a common

[redacted]

information portion of an uplink setup transmission that identifies information that is a function of the total number of space time streams. Thus, Merlin [0035] does not address or disclose ’738 patent limitation 1j.

1125. Dr Hansen also refers to Merlin 258 [0052] in his Report at ¶2133. This paragraph of Merlin indicates that it is desirable to minimize the amount of traffic passing between the AP and multiple STAs. In instances where there are multiple STAs sending uplink information to an AP, it is desirable to minimize the amount of traffic required to complete the uplink of all transmissions. This disclosure does not provide any detail with regard to including an identification of the total number of space time streams provided in a common information portion of an uplink setup information transmission.

1126. In ¶2134, Dr. Hansen also refers to Merlin 258, paragraph [0068] (which references Figure 8). This passage refers to communications between an AP and 3 user terminals, and notes that the user terminals may send a request message (REQ) 802A-C to the AP to request a UL MU MIMO TXOP to indicate it has data available to be transmitted to the AP. Figure 8 is shown below:

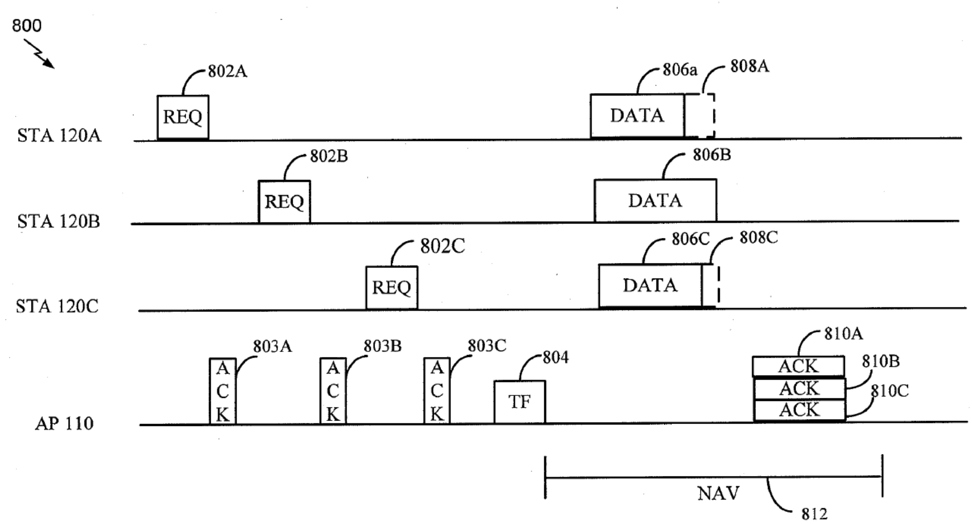


FIG. 8

[redacted]

1127. Once again, this disclosure does not provide any detail whatsoever regarding identifying information that is a function of the total number of space time streams in a common information portion of an uplink setup information transmission.

1128. Dr. Hansen, relative to limitations 1g, 1h and 1h (his Element 1[f]) acknowledges that the CTX frame 900 of Merlin 258 includes a UT Info field 930 that "contains information regarding a particular UT and may include a per-user terminal set 120 of information." Dr. Hansen Invalidity Report at ¶2099. The UT Info field includes a number of spatial streams field (N_{SS}) 935 "which indicates the number of spatial streams a terminal user may use." *Id.* at ¶1099. Thus, the number of spatial streams field (N_{SS}) referenced in Merlin 258 refers specifically to user-specific information, not common information for all of the user terminal devices. *See also* Hansen at ¶2101 (stating that each UT field is dedicated information)

1129. In summary, Dr. Hansen does not identify anything in the Merlin 258 published application that is relevant to Limitation 1j. This is entirely consistent with the prosecution history of the '738 patent, during which the Merlin 258 patent was specifically distinguished based on the additional of Limitation 1j. Dr. Hansen has not demonstrated that this decision by the patent examiner was clearly wrong.

11.5.1.4 Dependent Claims

1130. Claim 7 of the '738 patent specifies a SIFS period between the uplink setup frame and the UL MU frame from the plurality of stations, and also a SIFS period between the UL MU transmission and the acknowledgement frame.

1131. Dr. Hansen indicates that Merlin 258 uses a SIFS for time T 406 between the CTX frame and the user terminals transmitting the UL MU-MIMO transmissions, referencing Figure 6. Hansen at ¶2300. Dr. Hansen does not address the claimed requirement of the second SIFS period, between the UL MU transmission and the acknowledgment frame.

1132. I have reviewed Merlin 258 and I found no indication that Merlin specifies a SIFS interval between those exchanges. Figure 6, as well as the other figures in Merlin, do not

[redacted]

specify any particular time interval between the uplink MU transmission and any acknowledgment from the AP.

1133. Claim 9 has the same limitations as Claim 1 that are absent from Merlin 258, and thus my discussion of Limitation 1d, 1g and 1j apply also to Claim 9.

1134. Claim 15 is similar to claim 7, and thus the discussion relative to claim 7 also applies to claim 15.

1135. For these reasons, it is my opinion that Merlin '258 does not teach or suggest at least Limitations 1d, 1i, 7, 9 and 15.

1136. Nor would it have been obvious to modify Merlin 258 prior to April 4, 2014 to include these claimed features. In fact, as I have noted previously, the 258 published application was not filed until after that date, and Dr. Hansen has not identified any evidence showing an earlier date of invention by Merlin.

1137. I will address the exemplary prior combinations mentioned by Dr. Hansen and the motivation to combine below.

11.5.2 Yuan Fails To Disclose Or Render Obvious Several '738 Claim Limitations

1138. Yuan relates to the 3GGP cellular standard, rather than the 802.11 standard that is the focus of the '738 patent. Compare Yuan at [0003] and '738 patent at 1:23-42. While cellular communications (and the 3GPP standard) and Wi-Fi communications (and the 802.11 standard) both generally involve wireless communications, the problems and issues related to these technologies differs substantially. It is not fair to conclude, as Dr. Hansen suggests, that a skilled artisan would necessarily be motivated to combine the teachings of Yuan with 802.11 references. If that were the case, then the two standards would be much more similar than they are.

1139. According to Yuan, physical DL control channel (PDCCH) which carries control data, is time multiplexed with Physical DL Shared Channel (PDSCH) which carries downlink data. [0003]. The physical control channel usually occupies the entire first few

[redacted]

OFDM symbols, spanning the entire system bandwidth to allow earlier decoding of DL/UL grants. [0003]

1140. The Yuan published application is primarily concerned with resource multiplexing between the physical downlink control channel and the physical downlink data channel. Yuan at [0006]. Figure 1 shows different users being scheduled in subframes, with each subframe containing 2 slots. [0014] The resource region not belonging to the legacy Physical Downlink Control Channel (PDCCH) is shown in dark gray, while the light gray shows the enhanced physical downlink control channel (ePDCCH) transmission.

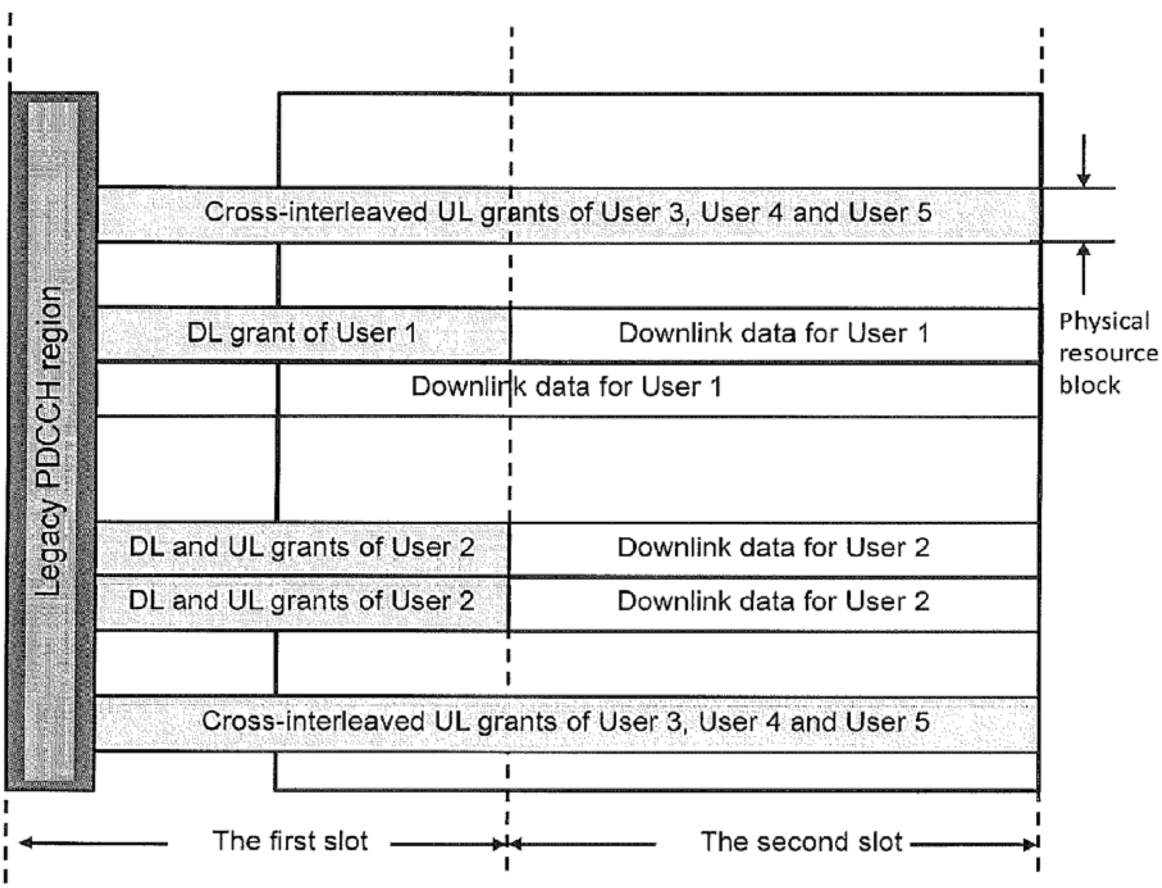


Figure 1

[redacted]

In this figure, User 1 has only a DL grant, with the 1st slot of the resource block providing the DL grant and the 2nd slot is used for User 1's downlink data transmission. The adjacent resource block also is used to for the downlink data transmission. The DL and UL grant of User 2 is mixed in the 1st slot of 2 adjacent resource blocks. The DL data for User 2 is transmitted in the 2nd slot of 2 adjacent resource blocks. UL grants of Users 3, 5 and 5 are cross-interleaved, and mapped to the 1st and 2nd slots of two non-adjacent resource blocks, which are frequency distributed.

1141. As Figure 1 of Yuan illustrates, the transmission of user specific grant information may occur in different time slots at different times, and the same is true of the downlink data. For example, the UL grant of Users 3, 4 and 5 may occur in multiple non-adjacent resource blocks and in both slots 1 and 2, whereas the grant for User 1 only occurs in a single resource unit and in the 1st time slot. The grant to user 2 occurs in multiple adjacent resource units, but also only in the 1st slot. The downlink data for user 1 spans 2 resource elements, and relative to the second resource unit, spans both the 1st slot and the 2nd slot. There is no downlink data for Users 3, 4, and 5, which have their grants interleaved across the entire resource element.

1142. There is no indication that the UL grant solicits an uplink multi-user frame. The uplink transmission that results from the uplink grant is not identified. While Yuan discusses DL and UL grants, Yuan only shows the transmissions of downlink data. Yuan is completely silent on any UL MU transmission from multiple user devices, and thus Yuan does not indicate that the UL grants will solicit a simultaneous UL MU response from a plurality of station devices. Further, the detail of what the content is of the DL and UL grant transmissions is not provided in Yuan.

1143. Dr. Hansen has not clearly shown that Yuan includes the limitations from the '738 patent identified below.

[redacted]

11.5.2.1 Limitation 1c: generating uplink setup information with information to be used in an uplink multi-user transmission

1144. Limitation 1c of the '738 patent recites generating uplink setup information, the uplink setup information including a first information to be used for uplink multi-user transmission.

1145. Yuan does not disclose this Limitation, as there is no indication in Yuan regarding the content of the UL grant transmission. Nor, as I noted above, does Yuan disclose uplink multi-user transmissions, so it necessarily follows that Yuan does not provide first information to be used for those UL MU transmissions. As the Overview of Yuan indicates, Yuan only mentions providing UL grants in certain instances with downlink data transmissions to a particular station.

1146. Nor does Dr. Hansen appear to contend that Yuan discloses Limitation 1c. *See* Hansen Report at ¶1969-2001. In fact, the only place where Yuan is mentioned relative to '738 Limitation 1c is in ¶2002, where Dr. Hansen states that in the event that any reference fails to disclose this element, it would have been obvious in view of any combination of the 8 references, including Yuan, despite the apparent acknowledgement that Yuan does not disclose this Limitation 1c.

1147. For these reasons, it is my opinion that Yuan does not teach or suggest Limitation 1c.

11.5.2.2 Limitation 1d: transmitting downlink data with the uplink setup information

1148. Limitation 1d requires transmitting downlink data together with the uplink setup information in a single physical downlink frame to a plurality of stations. Yuan does not disclose this Limitation 1d.

1149. Because Yuan does not disclose the claimed uplink setup information to be used in an UL MU transmission by a plurality of stations, it follows that Yuan also does not disclose transmitting a downlink frame with that uplink setup information as part of that downlink transmission.

[redacted]

1150. Although Dr. Hansen appears to acknowledge that Yuan does not generate the claimed uplink setup information, he confusingly indicates that Yuan does meet Limitation 1d, which requires transmitting that uplink setup information in a downlink frame. Dr. Hansen's opinion in this regard is contradictory – if Yuan doesn't disclose the claimed uplink setup information, it clearly cannot transmit such uplink setup information.

1151. Dr. Hansen block quotes paragraph [0014] of Yuan in his ¶2018. While that paragraph discusses transmitting downlink data in a frame with UL or DL grant information, there is nothing in [0014] of Yuan that remotely suggests that the grant includes information to be used in an UL MU transmission from a plurality of stations. Thus, the evidence cited by Dr. Hansen does not show that Yuan discloses this limitation 1d.

1152. For these reasons, it is my opinion that Yuan does not teach or suggest Limitation 1d.

11.5.2.3 Limitation 1e: simultaneously receiving multiple uplink frames from multiple stations

1153. Limitation 1e of the '738 patent recites simultaneously receiving multiple uplink frames from multiple stations.

1154. Yuan does not disclose this Limitation, because Yuan does not disclose uplink multi-user transmissions, so it necessarily follows that Yuan does not disclose an access point receiving simultaneously those UL MU transmissions. As the Overview of Yuan indicates, Yuan only mentions providing downlink data transmissions to a particular station.

1155. Nor does Dr. Hansen appear to contend that Yuan discloses Limitation 1e. *See* Hansen Report at ¶2043-2073. In fact, the only place where Yuan is mentioned relative to '738 Limitation 1e is in ¶2074, where Dr. Hansen states that in the event that any reference fails to disclose this element, it would have been obvious in view of any combination of

[redacted]

the 8 references, including Yuan, despite the apparent acknowledgement that Yuan does not disclose this Limitation 1e.

1156. For these reasons, it is my opinion that Yuan does not teach or suggest Limitation 1e.

11.5.2.4 Limitation 1f: transmitting an acknowledgement frame to the multiple stations

1157. Limitation 1f of the '738 patent recites transmitting an acknowledgment frame to the multiple stations after successful reception of the multiple uplink frames.

1158. Yuan does not disclose this Limitation, because Yuan does not disclose uplink multi-user transmissions, so it necessarily follows that Yuan does not provide an acknowledgement for those UL MU transmissions. As the Overview of Yuan indicates, Yuan only mentions providing downlink data transmissions to a particular station, and is totally silent on providing any acknowledgment information from an access point.

1159. Nor does Dr. Hansen appear to contend that Yuan discloses Limitation 1f. *See* Hansen Report at ¶2075-2096. In fact, the only place where Yuan is mentioned relative to '738 Limitation 1f is in ¶2097, where Dr. Hansen states that in the event that any reference fails to disclose this element, it would have been obvious in view of any combination of the 8 references, including Yuan, despite the apparent acknowledgement that Yuan does not disclose this Limitation 1f.

1160. For these reasons, it is my opinion that Yuan does not teach or suggest Limitation 1f.

11.5.2.5 Limitation 1g: wherein the uplink setup information includes a common information portion and a dedicated information portion

1161. Limitation 1g of the '738 patent recites that the uplink setup information includes common information and dedicated information.

1162. Yuan does not disclose this Limitation, as there is no indication in Yuan regarding the content of the UL grant transmission. Nor, as I noted above, does Yuan disclose uplink

[redacted]

multi-user transmissions. As the Overview of Yuan indicates, Yuan only mentions providing UL grants in certain instances with downlink data transmissions to a particular station.

1163. Nor does Dr. Hansen appear to contend that Yuan discloses Limitation 1g. *See* Hansen Report at ¶2098-2128. In fact, the only place where Yuan is mentioned relative to '738 Limitation 1g is in ¶2129, where Dr. Hansen states that in the event that any reference fails to disclose this element, it would have been obvious in view of any combination of the 8 references, including Yuan, despite the apparent acknowledgement that Yuan does not disclose this Limitation 1g.

1164. For these reasons, it is my opinion that Yuan does not teach or suggest Limitation 1g.

11.5.2.6 Limitation 1h: the common information includes second information common to the plurality of stations

1165. Limitation 1h of the '738 patent recites that the common portion of the uplink setup information includes second information that is common to the plurality of stations that receive the uplink setup information.

1166. Yuan does not disclose this Limitation, as there is no indication in Yuan regarding the content of the UL grant transmission. Nor, as I noted above, does Yuan disclose uplink multi-user transmissions, so it necessarily follows that Yuan does not provide second information that is common to the plurality of stations participating in the UL MU transmissions. As the Overview of Yuan indicates, Yuan only mentions providing UL grants in certain instances with downlink data transmissions to a particular station.

1167. Nor does Dr. Hansen appear to contend that Yuan discloses Limitation 1h. *See* Hansen Report at ¶2098-2128. In fact, the only place where Yuan is mentioned relative to '738 Limitation 1h is in ¶2129, where Dr. Hansen states that in the event that any reference fails to disclose this element, it would have been obvious in view of any combination of

[redacted]

the 8 references, including Yuan, despite the apparent acknowledgement that Yuan does not disclose this Limitation 1h.

1168. For these reasons, it is my opinion that Yuan does not teach or suggest Limitation 1h.

11.5.2.7 Limitation 1i: the dedicated information includes third information specific to each of the plurality of stations

1169. Limitation 1i of the '738 patent recites that the dedicated portion of the uplink setup information includes third information that is specific to the plurality of stations that receive the uplink setup information.

1170. Yuan does not disclose this Limitation, as there is no indication in Yuan regarding the content of the UL grant transmission. Nor, as I noted above, does Yuan disclose uplink multi-user transmissions, so it necessarily follows that Yuan does not provide third information that is specific to the plurality of stations participating in the UL MU transmissions. As the Overview of Yuan indicates, Yuan only mentions providing UL grants in certain instances with downlink data transmissions to a particular station.

1171. Nor does Dr. Hansen appear to contend that Yuan discloses Limitation 1i. *See* Hansen Report at ¶2098-2128. In fact, the only place where Yuan is mentioned relative to '738 Limitation 1i is in ¶2129, where Dr. Hansen states that in the event that any reference fails to disclose this element, it would have been obvious in view of any combination of the 8 references, including Yuan, despite the apparent acknowledgement that Yuan does not disclose this Limitation 1i.

1172. For these reasons, it is my opinion that Yuan does not teach or suggest Limitation 1i.

[redacted]

11.5.2.8 Limitation 1j: wherein the second information is a function of the total number of space time streams used to perform simultaneous transmission of the uplink frames

1173. Limitation 1j of the ’738 patent recites that the second information (which forms part of the common portion of the uplink setup information) is a function of a total number of space time streams used to perform the simultaneous transmission of the uplink frames.

1174. Yuan does not disclose this Limitation, as there is no indication in Yuan regarding the content of the UL grant transmission. Nor, as I noted above, does Yuan disclose uplink multi-user transmissions, so it necessarily follows that Yuan does not provide the specific second information recited in this claim that relates functionally to the total number of space time streams used for the UL MU transmission. As the Overview of Yuan indicates, Yuan only mentions providing UL grants in certain instances with downlink data transmissions to a particular station.

1175. Nor does Dr. Hansen appear to contend that Yuan discloses Limitation 1j. *See* Hansen Report at ¶2130-2169. In fact, the only place where Yuan is mentioned relative to ’738 Limitation 1j is in ¶2170, where Dr. Hansen states that in the event that any reference fails to disclose this element, it would have been obvious in view of any combination of the 8 references, including Yuan, despite the apparent acknowledgement that Yuan does not disclose this Limitation 1j.

1176. For these reasons, it is my opinion that Yuan does not teach or suggest Limitation 1j.

11.5.2.9 Dependent Claims

1177. Relative to dependent claims 2-7 of the ’738 patent, Dr. Hansen does not appear to contend that Yuan meets the limitations of any of these claims. I agree. As I noted above, Yuan provides no disclosure regarding the contents of the uplink setup information, which is the focus of dependent claims 2-6.

[redacted]

1178. With regard to claim 7, Yuan does not disclose anything regarding an UL MU transmission or an acknowledgement of that UL MU transmission, and thus it necessarily follows that Yuan does not identify the claimed SIFS interval between those transmissions.

1179. Relative to claim 8, Yuan does not disclose or mention any UL MU transmission, much less an UL MU-MIMO transmission from a plurality of stations. Thus, Yuan does not contain any relevant disclosure relative to claim 8.

1180. Claims 9-16 different from Yuan for the same reasons identified above relative to claims 1-8.

1181. For these reasons, it is my opinion that Yuan does not teach or suggest numerous limitations from the '738 claims as identified above.

1182. It would not have been obvious to modify Yuan prior to April 4, 2014 to include these claimed features. I will address the exemplary prior combinations mentioned by Dr. Hansen and the motivation to combine below. But generally the concepts disclosed in Yuan are not readily transferable to the teachings of other references, such as Merlin 258 or Chu.

1183. Nor would it have been obvious to modify the references specifically directed to 802.11 systems to incorporate the mixed time division multiplexing + frequency division multiplexing disclosed in Yuan. Yuan describes a concept that is specific to 3GPP cellular communications, which varies significantly in certain respects as compared to 802.11 WLAN communications. Specifically, Yuan proposes multiplexing between downlink control and downlink data channels using both time division multiplexing and frequency division multiplexing. Yuan at [0006]. The resource mapping proposed by Yuan covers using these two concepts together in downlink transmissions: (1) cross-interleaving control channel information (UL grants) of different users and mapping this control information to all the time slots of a resource block, while preventing downlink data from being transmitted in those resource blocks; and (2) including control channel information (DL grant and UL grant if present) of one user and mapping that information to only the 1st time slot or a resource block, while allowing downlink data to be transmitted in the 2nd time slot

[redacted]

of that same resource block. The manner in which these concepts would have been used or implemented in the context of 802.11 is never explained in the Hansen report, and there is nothing in Yuan that even remotely suggests using these techniques for other protocols.

1184. Backwards compatibility is another important consideration when developing or modifying requirements in a standard. Consequently, any modifications to 802.11, for example, must consider the impact that any modifications would have on the ability of legacy devices to continue to operate. The idea of permitting control information and/or data to be specifically located in certain slots of resource units in some instances, but allowing control information and/or data to be located in all slots of resource units in other instances, as suggested by Yuan, poses significant questions regarding backwards compatibility, especially as those concepts are attempted to be migrated to other standards, such as 802.11.

1185. Yuan notes the issues with backwards compatibility relative to 3GPP, as it suggests including a legacy downlink control channel (PDCCH) region in addition to the extensions it proposes. Figure 1 shows an enhanced PDCCH transmission added to the legacy PDCCH region. This enhanced control channel region thus is tacked onto a legacy control channel transmission. There is no suggestion or concept provided by Dr. Hansen of how Yuan's mixed time division multiplexing + frequency division multiplexing for an extension control channel would be applied to 802.11

1186. Further, the teaching of Yuan is to only include downlink data in the PDCCH transmission in the limited situation where a DL grant is provided to a specific User. Nothing in Yuan suggests including downlink data with an uplink grant to a plurality of stations. Thus, it appears that Dr. Hansen is suggesting that the concepts suggested in Yuan be further modified based on the '738 patent, and not on the teachings of the references themselves. I understand that using the teachings of the '738 patent to reconstruct or alter the teachings of any alleged prior art is an improper use of hindsight.

[redacted]

1187. Finally, Yuan is completely silent on 2 fundamental aspects of the ’738 claims. First, the ’738 claims are drawn to providing uplink setup information to initiate an UL MU transmission from multiple stations, with those UL MU transmissions using information provided in the UL setup information to construct those transmissions. Yuan does not disclose UL MU transmissions, so it follows that Yuan does not disclose providing uplink setup information to trigger UL MU transmissions. Dr. Hansen appears to concede this.

1188. Second, the ’738 claims provide very specific requirements regarding the structure and content of the uplink setup information. Yuan is silent on the content of its control channel information, and thus it discloses nothing relative to these aspects of the ’738 claims. Dr. Hansen appears to also concede this.

1189. To the extent Yuan is relevant at all, it is solely for the notion that downlink data may be transmitted with control channel information, but Yuan describes very specific techniques for how this should be done, using both time division multiplexing in conjunction with frequency division multiplexing. There is no indication of how and why these techniques would have been applicable to WLAN communications in April 2014.

1190. Finally, I note that Yuan was considered in combination with Merlin 258 and Zhang during the prosecution of the ’738 patent, as I noted in the ’738 Prosecution History section above. The patent examiner allowed the claims based on that combination of references.

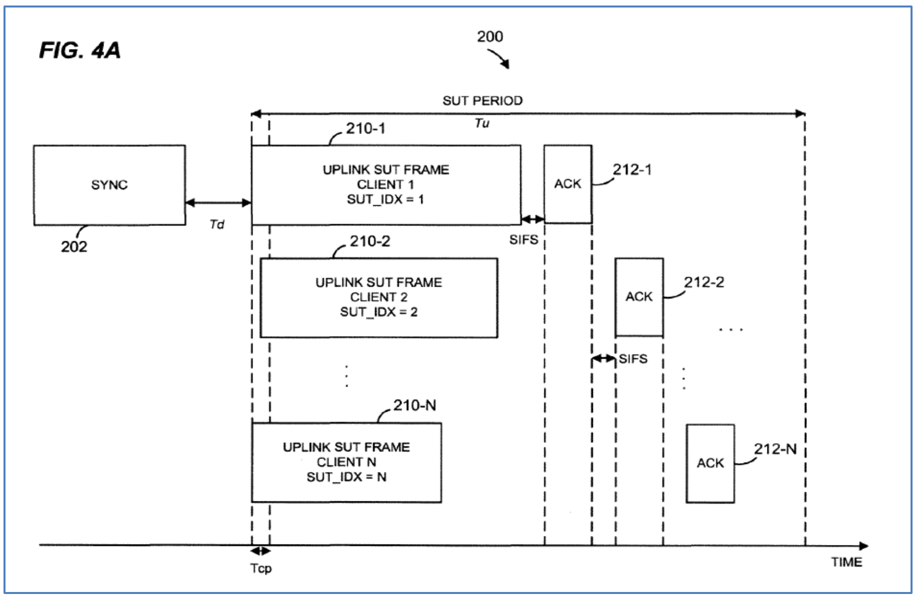
11.5.3 Zhang Fails To Disclose Or Render Obvious Several ‘738 Claim Limitations

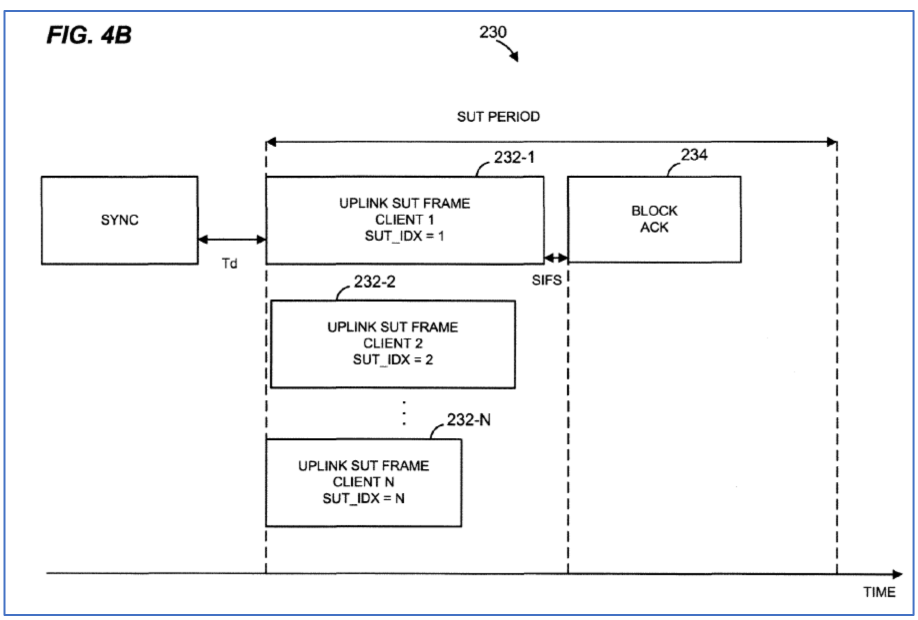
1191. The Zhang Summary describes a synchronization data unit that is transmitted to a plurality of devices, with the synchronization data unit specifying a space-time mapping parameter. A plurality of data units are transmitted simultaneously from some of the plurality of devices in accordance with the space-time mapping parameter. Zhang at 1:60-67.

[redacted]

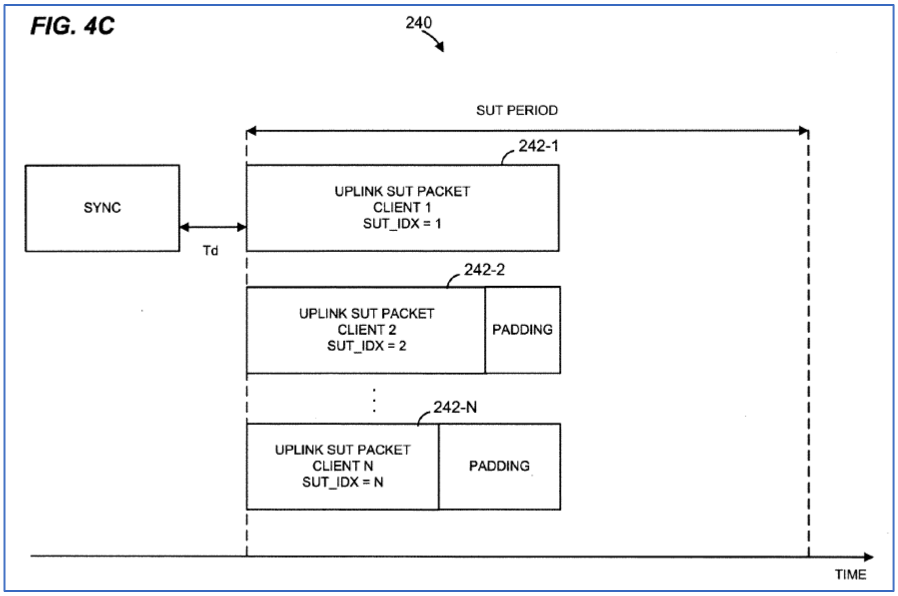
1192. In Zhang, an AP receives simultaneous UL transmission frames from several client stations via an antenna array. 3:31-36. The AP schedules a protected time period for use by the STAs, provides information to the clients that support this functionality, receives in parallel several frames of the same or different duration, and acknowledges receipt of the frames in a single ACK or in station-specific frames. 3:36-43.

1193. The synchronization data unit (SUT) is depicted in Figures 4A-4C of Zhang:





[redacted]



1194. According to the Zhang specification, the AP also controls (i) the power at which stations transmit SUT frames during the protected time period, (ii) the maximum duration of an SUT frame, (iii) the amount of bandwidth allocated to each station, etc., and/or one or more of (iv) assigns unique indexes to stations, (v) generates modulation and coding scheme (MCS) parameters for each station, (vi) allocates spatial (or "space-time") streams to stations. Zhang at 3:43-51. With regard to the space-time stream indication, Zhang explains that the AT controls the number of space-time streams and allocates the space-time streams to individual SUT-capable STAs. 12:1-4. Note that Zhang does indicate that the AP may also provide the total number of space-time streams available for uplink transmission together with a listing of space-time streams allocated to each individual STA. Zhang '010 at 10:37-41; *see also* 14:15-18.

[redacted]

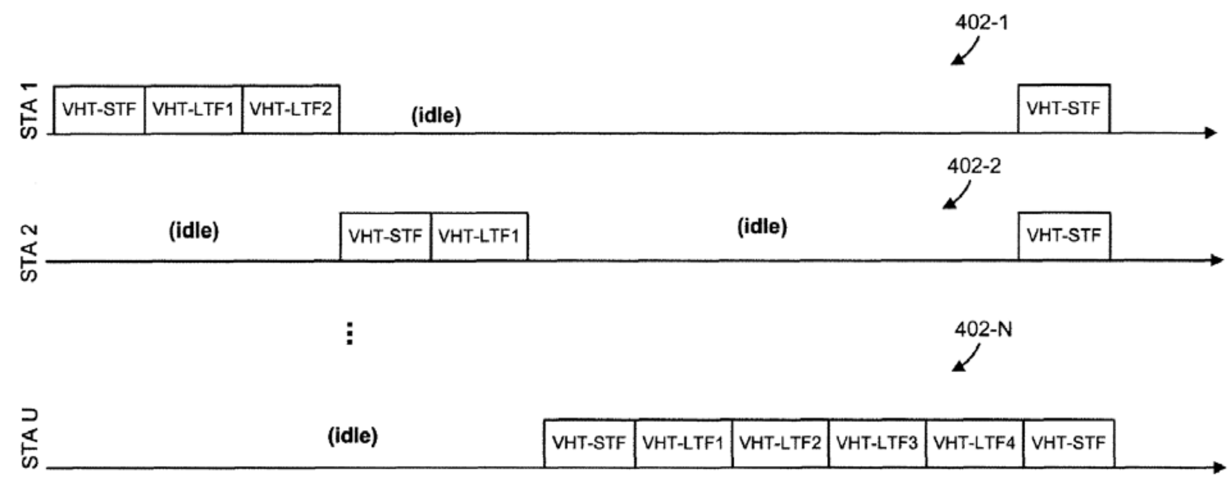


FIG. 6B

According to the Zhang patent, "each station transmits at least as many VHT-LTFs as space-time streams assigned to the station by the AP." 15:45-47. Thus, the number of VHT-LTFs is determined based on the number of space-time streams assigned to that particular station.

1195. Zhang was considered during the prosecution of the '738 patent, together with Merlin 258 and Yuan. The Examiner allowed the '738 patent over that combination of references.

1196. Dr. Hansen has not clearly shown that Zhang includes the limitations from the '738 patent identified below.

11.5.3.1 Limitation 1d: transmitting downlink data and uplink setup information in a single physical downlink frame to a plurality of stations

1197. Claim 1 of the '738 patent requires transmitting downlink data and uplink setup information in a single physical downlink frame to a plurality of stations.

[redacted]

1198. Dr. Hansen states that Zhang teaches Limitation 1d. Hansen Report at ¶1943-1945. I disagree that Zhang discloses this limitation, and the passages from Zhang quoted by Dr. Hansen do not support his conclusion that this limitation is met.

1199. In his ¶2022, Dr. Hansen refers to Zhang at 10:19-25 as disclosing this Limitation 1d of the '738 patent. This passage refers to Figure 4A and indicates that an AP allocates a protected SUT period. The AP controls synchronization and timing of the SUT period by generating a synchronization frame 202 and broadcasting it to SUT-capable STAs. There is nothing in this passage from Zhang that discloses transmitting data with the uplink setup information.

1200. Further, Figure 4A does not show the transmission of any data by the AP:

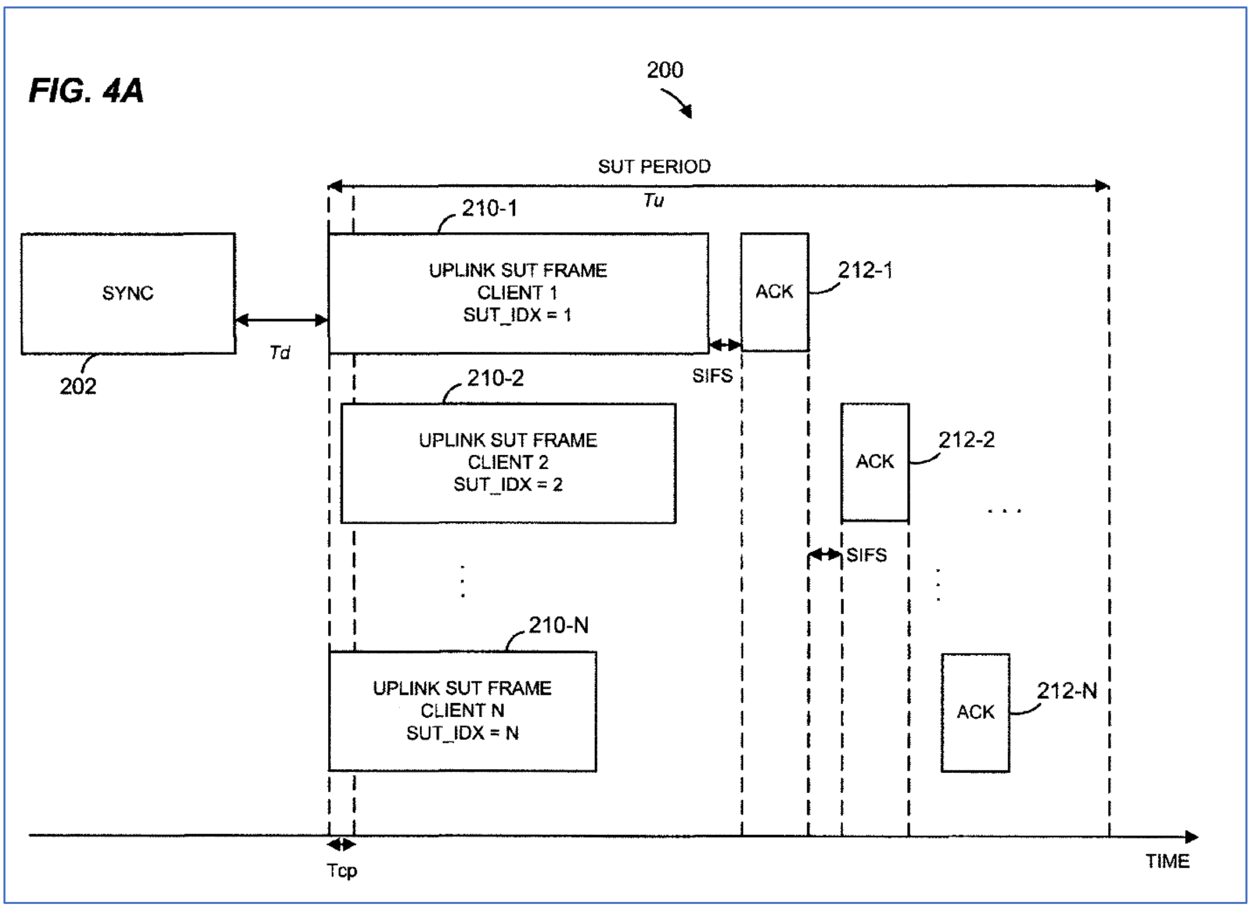


FIG. 4A

[redacted]

Figure 4A shows a Sync frame from an access point, which is followed by an SUT period during which clients may send an uplink transmission. There is no detail provided in Zhang regarding any data provided by the AP to the stations as part of the Sync frame.

1201. The Zhang patent was considered during the prosecution of the ’738 patent. The Examiner appeared to acknowledge that Zhang did not disclose Limitation 1d. *See* ’738 PH at 263; 280 (citing Yuan for this limitation in the 2nd office action).

1202. For these reasons, it is my opinion that Zhang does not teach or suggest Limitation 1d.

11.5.3.2 Limitation 1g: wherein the uplink setup information includes a common information portion and a dedicated information portion

1203. Claim 1 of the 738 patent requires that the uplink setup information is configured to include a common information portion and a dedicated information portion. Thus Claim 1 requires that the single physical downlink frame includes a specific organization, defining a common information portion and a dedicated user portion. Limitation 1g (together with Limitations 1h and 1i) capture that organization.

1204. Dr. Hansen states that Zhang teaches Limitations 1g and 1h. Hansen Report at ¶2105-2107. I disagree. Hansen fails to identify or explain how Zhang meets this specific organization recited in these claim limitations.

1205. While the excerpts from the Zhang identify various parameters that are transmitted by an AP, there is nothing that indicates a discrete information portion defining a common field and a dedicated information portion. The block quotes from Zhang do not clearly establish the sort of organization of common information that Claim 1 requires in limitations 1g and 1h. Further, Dr. Hansen does not explain how these parameters from Zhang would have been organized to define this common information portion consistent with Limitations 1g and 1hi.

[redacted]

11.5.3.3 Limitation 1j: wherein the second information is a function of a total number of space time streams to be used to transmit the multiple uplink frames

1206. Dr. Hansen asserts that Zhang meets Limitation 1g of '738 Claim 1, citing to Zhang at 10:19-47. Report at ¶2106. Dr. Hansen, however, never identifies which portion of the synchronization frame corresponds to a common information portion. Then, relative to Limitation 1j, Dr. Hansen cites to Zhang at 10:29-47 as meeting Limitation 1j. Hansen Report at ¶2106. I disagree that Zhang discloses this Limitation 1j, and the passages from Zhang quoted by Dr. Hansen do not support his conclusion that this limitation is met.

1207. The passage that Dr. Hansen cites identifies the parameters that may be provided by the AP in a synchronization frame 202. This includes the total number of space-time streams available for uplink transmission**.** Zhang at 10:37-38. Note that Zhang appears to be referencing the total number of streams ***available***, <u>not</u> the total number of space time streams "**to be used to transmit the multiple uplink frames**," as per Claim 1**.** The number of available streams only refers to the number of streams that a device may theoretically support, based on the number of antennas, for example. But this theoretical availability is not the same thing as the total number of streams actually to be used for a particular multi-user uplink transmission.

1208. This exact issue was discussed and addressed during the prosecution of the '738 patent. '738 PH at 330, 344, 350-351. Specifically, after amending the claims to add this Limitation 1j to overcome the combined teachings of Merlin 258, Yuan and Zhang, the patent owner Newracom stated relative to Zhang:

> Zhang discloses transmitting information on a "total number of space-time streams available for uplink transmission," Zhang, col. 10, ll. 37-38, but does not disclose transmitting the information on a total number of spatial streams actually <u>used</u> to perform multiple uplink frames, as recited in the present claims. The number of stream used may be different (in particular, may be less) than the number of streams available.

[redacted]

’738 PH at 330. The examiner subsequently agreed that Zhang did not, in fact, include the concept of including in an uplink setup transmission information that related functionally to the total number of streams actually to be used. [cite]. He allowed the ’738 claims after this amendment. [cite]

1209. I agree with the patent examiner that neither Zhang, Merlin nor Yuan disclose this Limitation 1j. The passage from Zhang on which Dr. Hansen relies states that the synchronization frame may identify the total number of streams available, but that does not correlate to the claimed requirement of identifying information related functionally to the total number of space time streams to be used:

> duration Tu), according to an embodiment. Further, depending on the particular embodiment, the synchronization frame **202** includes one or more of the following: an indication of which of the SUT-capable stations are expected to transmit uplink data during the SUT period **200**, a respective index assigned to each SUT-capable station expected to communicate during the SUT period **200**, the total number of space-time streams available for uplink transmission, a listing of space-time streams allocated to each individual SUT-capable station for the SUT period **200**, bandwidth of SUT frames (e.g., 20 MHz, 40 MHz, 80 MHz), a respective modulation and coding scheme for each SUT-capable station expected to transmit during the SUT period **200**, a respective power control parameter for each SUT-capable station expected to transmit during the SUT period **200**, the maximum duration of an SUT frame that can be transmitted during the SUT period **200**, etc.

Zhang at 10:31-47. In addition to failing to define information relating to the total number of streams actually to be used, it is not clear from Zhang that this information necessarily would be provided in a common information field of the synchronization frame when most if not all of the other listed parameters in that sentence appear to refer to dedicated information. Certainly Zhang does not clearly demarcate that the total stream information is commonly applied and used by each of the stations. In fact, Zhang makes no attempt to apportion the information provided into a common field and a dedicated field, but instead

[redacted]

identifies a number of possible parameters without any sort of organization or grouping. In addition, this passage also references identifying the particular streams allocated to particular users, which clearly is not common information, as was also the case with Merlin 258 as discussed above.

1210. The Zhang patent refers to the number of space-time streams on several occasions. None of those passages state that the space-time stream information provided in Zhang is (i) part of a common information field; and (ii) represents the total number of space time streams "to be used to transit the multiple uplink frames" as required in Limitation 1j.

1211. The Summary in Zhang indicates that the synchronization frame specifies a space-time mapping parameter and data is received from the plurality of devices in accordance with the space-time mapping parameter. The space-time mapping parameter is information that is user specific, and it is used by the station to identify on which space time stream it should transmit its data. This discussion is consistent with the description in 7:49-57 (describing using matrix to map values). The space-time mapping parameter does not identify a total number of space time streams.

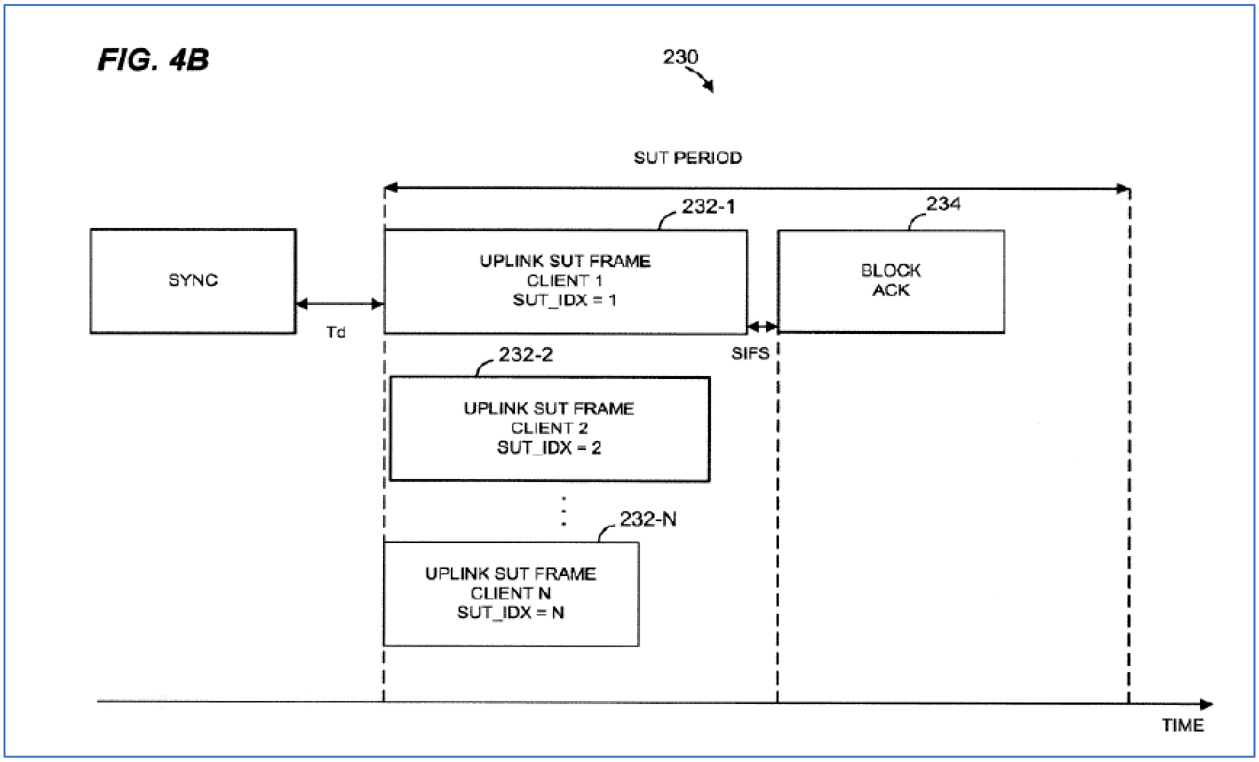
1212. Ultimately, Dr. Hansen's reliance on the Zhang patent suffers from the same deficiencies that existed relative to Merlin 258.

11.5.3.4 '738 Dependent claims

1213. Dependent claim 7 specifies a SIFS period between the uplink setup frame and the UL MU response, and also between the UL MU transmission and the subsequent acknowledgment frame. Zhang does not disclose both SIFS periods.

1214. Dr. Hansen in ¶2302-2307 discusses Zhang, but the only SIFS period he identifies is between the SUT transmission and the acknowledgement. He does not identify any SIFS period between the synchronization frame (which he contends is an uplink setup frame) and the SUT transmission. This is apparent from Figure 4B of Zhang, copied below:

[redacted]



1215. Thus, Zhang does not disclose both SIFS intervals recited in Claim 7.

1216. Claims 9 and 15 include the same limitations as claims 1 and 7, and thus include the same distinctions as noted relative to Claims 1 and 7.

11.5.4 Merlin '690 Fails To Disclose Or Render Obvious Several '738 Claim Limitations

1217. The Merlin published application describes multiple user uplink acknowledgement (ACK) transmissions. As one example, UL MU MIMO or FDMA may be used to transmit multiple Block Acknowledgements (BAs) at the same time. A Block Acknowledgement Request (BAR) frame is used to solicit multiple immediate acknowledgement responses. Merlin 690 at [0050].

1218. As I noted above, the Merlin 690 published application is not prior art to the 738 patent, which claims priority to April 4, 2024. The Merlin 690 published application was filed in October 2014, and published May 2015. Nonetheless, I will briefly address Merlin 690 relative to certain claim limitations.

[redacted]

1219. Dr. Hansen has not clearly shown that Merlin 690 includes the limitations from the ’738 patent identified below.

11.5.4.1 Limitation 1c: generating uplink setup information with information to be used in an uplink multi-user transmission

1220. Limitation 1c of the ’738 patent recites generating uplink setup information, the uplink setup information including a first information to be used for uplink multi-user transmission.

1221. Dr, Hansen does not indicate that Merlin 690 meets this Limitation 1c. *See* Hansen Report at ¶¶1969-2002. Thus, it does not appear that Dr. Hansen is relying on Merlin 690 for this limitation and consequently I have not addressed this limitation relative to Merlin 690.

11.5.4.2 Limitation 1d: transmitting downlink data and uplink setup information in a single physical downlink frame to a plurality of stations

1222. Limitation 1d requires transmitting downlink data together with the uplink setup information in a single physical downlink frame to a plurality of stations. Because Merlin 690 does not disclose the claimed uplink setup information to be used in an UL MU transmission by a plurality of stations (Limitation 1c), it follows that it also does not disclose transmitting a downlink frame with that uplink setup information as part of that downlink transmission.

1223. Despite not referencing Merlin 690 for Limitation 1c, *see* Hansen Report at ¶¶1969-2002, he indicates that Merlin 690 meets Limitation 1d, which requires transmitting that uplink setup information in a downlink frame. Dr. Hansen’s opinion in this regard is contradictory – if Merlin 690 doesn’t disclose the claimed uplink setup information, it clearly cannot transmit such uplink setup information.

1224. Dr. Hansen in ¶2008 block quotes paragraphs [0114]-[0116] of Merlin 690. These paragraphs refer to Figure 4 of Merlin, and describe a DL MU transmission from an AP to a plurality of STAs, with the STA’s responding with sequential ACK.

[redacted]

2009. Merlin at Figure 4:

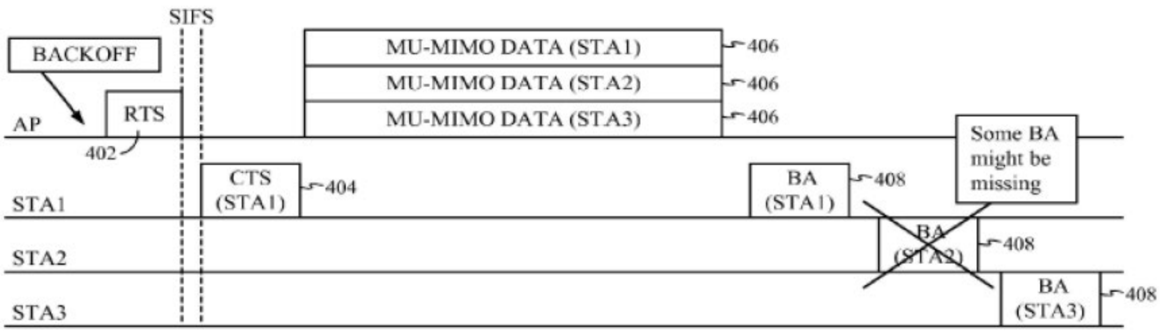


FIG. 4

Thus, as shown in Figure 4, there is no multi-user uplink transmission from a plurality of station devices. It follows that there is no uplink setup information, provided by the AP as part of the MU-MIMO DL transmission, that solicits a UL MU transmission. Without the requisite uplink setup information, Merlin 690 does not meet the requirements of Limitation 1d. Figure 4 and the related discussion in Merlin 690 does not meet this Limitation 1d.

1225. Dr. Hansen also references other portions of Merlin 690 that relate to a different embodiment. Hansen Report at ¶2012. Unlike the passage above, which described a DL MU transmission, Merlin at [0172] describes a special frame that includes information for multiple MU-MIMO packets. This special frame may define STA groups that may transmit PPDUs, and define certain parameters to be used by the STAs in the group. There is no identification of any download data within the aforementioned special frame in [0172].

1226. Dr. Hansen also references [0176] and [0187] and Figure 21 of Merlin 690, which relate to yet another embodiment. Merlin at [0176] states that special frames may be aggregated into A-MPDUs that form the data payload of downlink transmissions, which indicate to the STAs receiving these data payloads that they are to transmit immediately after receiving the special frames. This concept is illustrated in Figure 21:

[redacted]

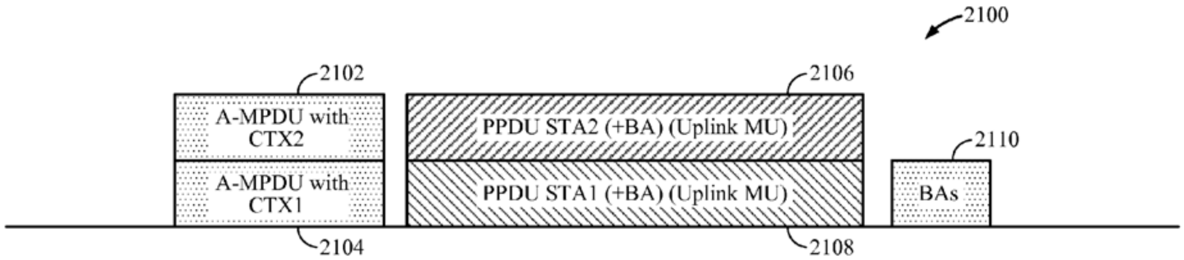


FIG. 21

DL MU-MIMO or DL FDMA to STA1 and STA2

Paragraph [0176] indicates that the uplink frame will use the same transmission type as the downlink frame. This suggests that information regarding the uplink transmission may be derived, at least in part, based upon the parameters used in the downlink transmission instead of conveying that information in uplink setup information. Further, the special frame may be addressed to a single station [0176] and aggregated in the A-MPDU, presumably with other special frames if more than 1 station is to be targeted. According to the description associated with Figure 21, "each A-MPDU [is] aggregated with a special frame (CTX2 and CTX1)." Merlin 690 at [0176]

1227. Dr. Hansen does not clearly indicate if the special frame is uplink setup information or if it is downlink data. Merlin 690 seems to suggest in [0176] that one special frame is provided in the payload of an MPDU, and multiple of these MPDUs may be aggregated together as an A-MPDU in the downlink transmission. While Merlin 690 indicates that the special frame may be aggregated into A-MPDUs it is unclear what other information is to be included in the A-MPDUs other than the special frame. Dr. Hansen does not clearly identify what he contends is uplink setup information and what he contends is downlink data in his ¶2013 relative to the Figure 21 embodiment and the description in [0176]. Instead, he simply copies passages from Merlin 690 without further explanation that clarifies how this claim limitation is met by Merlin 690.

1228. Further, if Dr. Hansen is suggesting taking different aspects of different embodiments to meet the requirement of uplink setup information and downlink data, he

[redacted]

has not explained how these embodiments would be used together in the same transmission.

1229. Lastly, [0187] of Merlin 690 again refers to the special frame with regard to Figure 26. Once again, Dr. Hansen doesn't clearly indicate if this special frame refers to downlink data or an uplink setup information. Hansen Report at ¶2015. Instead, he simply copies passages from Merlin 690 without further explanation that clarifies how this claim limitation is met by Merlin 690.

11.5.4.3 Limitation 1e: simultaneously receiving multiple uplink frames from multiple stations of the plurality of stations

1230. It does not appear that Dr. Hansen contends Merlin 690 meets this Limitation 1e. Hansen Report at ¶¶2043-2074. Consequently, I will not address this Limitation relative to Merlin 690.

11.5.4.4 Limitation 1f: transmitting an acknowledgement frame to the multiple stations after a successful reception of the multiple uplink frames

1231. It does not appear that Dr. Hansen contends Merlin 690 meets this Limitation 1f. Hansen Report at ¶¶2075-2097. Consequently, I will not address this Limitation relative to Merlin 690.

11.5.4.5 Limitation 1g: wherein the uplink setup information includes a common information portion and a dedicated information portion

1232. It does not appear that Dr. Hansen contends Merlin 690 meets this Limitation 1g. Hansen Report at ¶¶2098-2129. Consequently, I will not address this Limitation relative to Merlin 690.

11.5.4.6 Limitation 1h: the common information portion includes a second information being common to all of the plurality of stations to receive the uplink setup information,

1233. It does not appear that Dr. Hansen contends Merlin 690 meets this Limitation 1h. Hansen Report at ¶¶2098-2129. Consequently, I will not address this Limitation relative to Merlin 690.

[redacted]

11.5.4.7 Limitation 1i: the dedicated information portion includes respective third information specific to each of the plurality of stations to receive the uplink setup information

1234. It does not appear that Dr. Hansen contends Merlin 690 meets this Limitation 1i. Hansen Report at ¶¶2098-2129. Consequently, I will not address this Limitation relative to Merlin 690.

11.5.4.8 Limitation 1j: wherein the second information is a function of the total number of space-time streams to be used to transmit the multiple uplink frames

1235. It does not appear that Dr. Hansen contends Merlin 690 meets this Limitation 1j. Hansen Report at ¶¶2130-2170. Consequently, I will not address this Limitation relative to Merlin 690.

1236. There is nothing in Merlin 690 that discloses a common information portion of an uplink setup transmission with information that relates functionally to the total number of space time streams to be used in an UL MU transmission.

1237. Further, as I noted above, there is no indication that the Merlin 690 published application is prior art to the ’738 patent. Merlin 690 was filed October 30, 2014, after the priority filings of the ’738 patent, which I have explained support Claim 1 and Claim 9. Dr. Hansen, conversely, has not addressed any provisional filing of Merlin 690 to entitle Merlin 690 to an earlier priority date.

11.5.4.9 Dependent Claims

1238. It does not appear that Dr. Hansen contends that Merlin 690 meets these Limitations from the dependent claims. Hansen Report at ¶¶2171-2345. Consequently, I will not address Limitations in claims 2-8 relative to Merlin 690.

1239. Claim 9 has limitations similar to Claim 1, except it is written from the perspective of Claim 1. Claim 9 has the same distinctions as Claim 1.

1240. Dr. Hansen also does not appear to contend that Merlin 690 meets the Limitations of Claims 10-16. Hansen Report at ¶¶2359-2379.

[redacted]

1241. The obviousness issues are the same as addressed above for Merlin '258, as TP-Link only provided a single obviousness chart for the '738 Patent

11.5.5 Vermani Fails To Disclose Or Render Obvious Several '738 Claim Limitations

1242. Vermani 335 (referred to in this section as Vermani) was filed in July 2014, and was published in January 2015. Thus it is not prior art to the 738 patent, which has a priority date in April 2014. Dr. Hansen has not addressed any of the provisional applications on which Vermani has relied and thus he has not shown that Vermani has a date of invention earlier than the 738 patent. Nonetheless, I will briefly address Vermani relative to the 738 patent.

1243. Vermani describes a physical layer design for uplink multi-user MIMO transmissions. The transmissions include a packet with a preamble portion. The preamble includes a long training field (LTF); a first signal (SIG) field subsequent to the LTF; one or more other LTFs located subsequent to the first SIG field; and at least one second SIG field, wherein all SIG fields in the preamble portion, other than the first SIG field, are subsequent to the other LTFs. Vermani at Abstract; [0009]. The Vermani Abstract also describes another embodiment in which transmissions include a packet having a preamble portion comprising tone-interleaved LTFs that have a frequency offset adjustment based on the tone-interleaved LTFs.

1244. Dr. Hansen has not clearly shown that Vermani includes the limitations from the '738 patent identified below.

11.5.5.1 Limitation 1b: generating downlink data

1245. Limitation 1b recites generating downlink data. Dr. Hansen does not appear to contend that Vermani meets this limitation. *See* Hansen Validity Report at ¶¶1928-1968.

1246. Because Dr. Hansen does not indicate that Vermani meets Limitation 1b, I will not address that limitation further.

[redacted]

11.5.5.2 Limitation 1c: generating uplink setup information with information to be used in an uplink multi-user transmission

1247. Limitation 1c of the ’738 patent recites generating uplink setup information, the uplink setup information including a first information to be used for uplink multi-user transmission.

1248. Dr, Hansen does not indicate that Vermani meets this Limitation 1c. *See* Hansen Report at ¶¶1969-2002. Thus, it does not appear that Dr. Hansen is relying on Merlin 690 for this limitation, and thus I will not address Vermani relative to this Limitation.

11.5.5.3 Limitation 1d: transmitting downlink data and uplink setup information in a single physical downlink frame to a plurality of stations

1249. Limitation 1d requires transmitting downlink data together with the uplink setup information in a single physical downlink frame to a plurality of stations. Because Vermani does not disclose the claimed downlink data (Limitation 1b) nor uplink setup information to be used in an UL MU transmission by a plurality of stations (Limitation 1c), it follows that Vermani also does not disclose transmitting a downlink frame with that uplink setup information as part of that downlink transmission. Nor does Dr. Hansen contend that Vermani meets this Limitation. Hansen Invalidity Report at ¶¶2003-2042.

11.5.5.4 Limitation 1e: simultaneously receiving multiple uplink frames from multiple stations of the plurality of stations

1250. It does not appear that Dr. Hansen contends Vermani meets this Limitation. Hansen Report at ¶¶2043-2074 Consequently, I will not address this Limitation relative to Vermani.

11.5.5.5 Limitation 1f: transmitting an acknowledgement frame to the multiple stations after a successful reception of the multiple uplink frames

1251. It does not appear that Dr. Hansen contends Vermani meets this Limitation. Hansen Report at ¶¶2075-2097. Consequently, I will not address this Limitation relative to Vermani.

[redacted]

11.5.5.6 Limitation 1g: wherein the uplink setup information includes a common information portion and a dedicated information portion

1252. It does not appear that Dr. Hansen contends Vermani meets this Limitation. Hansen Report at ¶¶2098-2129. Consequently, I will not address this Limitation relative to Vermani.

11.5.5.7 Limitation 1h: the common information portion includes a second information being common to all of the plurality of stations to receive the uplink setup information,

1253. It does not appear that Dr. Hansen contends Vermani meets this Limitation. Hansen Report at ¶¶2098-2129. Consequently, I will not address this Limitation relative to Vermani.

11.5.5.8 Limitation 1i: the dedicated information portion includes respective third information specific to each of the plurality of stations to receive the uplink setup information

1254. It does not appear that Dr. Hansen contends Vermani meets this Limitation. Hansen Report at ¶¶2098-2129. Consequently, I will not address this Limitation relative to Vermani.

11.5.5.9 Limitation 1j: wherein the second information is a function of the total number of space-time streams to be used to transmit the multiple uplink frames

1255. Although Dr. Hansen does not contend that Vermani disclosed uplink setup information with a common information portion, he contends Vermani meets this Limitation 1j. Hansen Invalidity Report at ¶¶2141-2150.

1256. Dr. Hansen cites paragraphs [0112] – [0117] and Figure 3A of Vermani. Hansen Report at ¶¶2142-2148. These passages from Vermani do not indicate that the access point transmits uplink setup information with a common information portion that includes information that is a function of the total number of space time streams to be transmitted by the users. At most, Vermani identifies the number of HE-LTF fields, and that this number may be the same as the number of HE-LTF as that for DL MU MIMO transmission. [0116] – [0117].

[redacted]

1257. In [0112], Vermani states that his disclosure provides preamble formats and other PHY aspects that may be used in HEW WiFi, including for UL MU-MIMO. The next paragraph [0113] then notes that for UL MU-MIMO, a prior setup by an AP may occur, which includes certain information such as a stream allocation, a frequency correction reference, a precise time to transmit and power control information. Vermani does not indicate or suggest that this information is common information. In fact, he does not appear to organize the information provided in any particular manner. Further, this information appears to be station specific information, although Vermani is silent on that point.

1258. Vermani in [0114] then indicates that the UL MU-MIMO may involve similar specifications as DL MU-MIMO. This includes allowing up to 8 spatial streams total with 4 streams maximum per STA, with a maximum of 4 users.

1259. The next section of Vermani refers to a Mixed Mode Preamble format (Option 1a). Paragraph [0115] refers to Figure 3A, and notes that the data portion includes data for each spatial streams transmitted by each user.

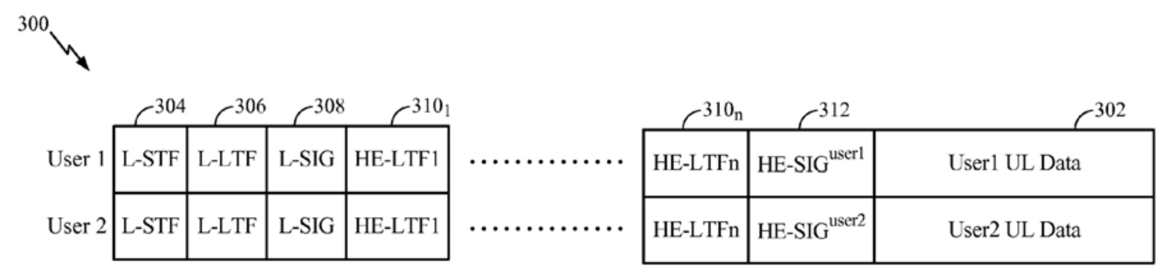


FIG. 3A

1260. Paragraph [0116] describes the different fields of the preamble, as shown in Figure 3A.

1261. Relative to the HE-LTF field, Vermani states that the number (n) of HE-LTF fields "is determined by the total number of uplink streams, which may be the same as that for downlink (DL) MU-MIMO." Vermani at [0116]. Thus, Vermani instructs that the decision regarding the total number of uplink streams is determined based on the number of streams used in the downlink transmission. Vermani in [0116] does not indicate that the AP sends

[redacted]

a message regarding the total number of HE-LTF symbols or the total number of spatial streams to be used in the uplink transmission. Instead, Vermani teaches that the number of streams is derived based on the downlink transmission streams, with the number of uplink streams matching the number of downlink streams.

1262. In the subsequent paragraph [0117], Vermani states:

> **[0117]** Prior to the uplink transmit opportunity (TXOP), the AP **110** may inform the client which streams to use and the maximum TXOP duration. The client can still decide the modulation and coding scheme (MCS) and the packet length (<max TXOP duration). The number of streams is an upper constraint. A lower number of streams in data may be transmitted by the client, but the number of LTFs should stay the same as the total number of streams decided by the AP **110** and provided in the AP's message transmitted to the client. For certain aspects, the client may transmit zeros on the unused stream(s). The maximum TXOP duration may be used as a spoof length by uplink clients in the L-SIG field. Each client may transmit an identical L-SIG field **308**, but with different cyclic shifts. Cyclic shift delays (CSDs) here may most likely be much larger than legacy CSDs for accurate gain setting, which might cause issues for legacy devices which use cross-correlation.

According to this passage, Vermani indicates that the AP may inform the client which streams to use and the TXOP direction, while the client may independently determine other parameters such as the MCS to use. Further, the client may determine to use less streams than indicated by the AP, but the number of LTFs should stay the same as decided by the AP.

1263. Nothing in Vermani references setup information with a common information portion and a dedicated information portion. Nor does Dr. Hansen indicate that Vermani discloses this information regarding the manner in which the uplink setup information is organized. Vermani does not indicate that the number of HE-LTF fields or the number of spatial streams are identified in a common information portion of uplink setup information. Vermani is silent regarding the organizational structure of the uplink setup information, or the timing of when and how that information is provided. Further, Vermani seems to

[redacted]

suggest that some information is determined independently by the clients, and some is derived based on the parameters used in a prior DL transmission (versus providing that information in discrete fields of an uplink setup transmission or frame).

1264. Despite the information provided by Vermani, Dr. Hansen then states in ¶2149 that a POSITA would understand that the total number of streams is the same for each station and "must be communicated to all client stations" and therefore "it would be a part of the 'common information portion.'" Vermani does not support this conclusion, and Vermani simply does not identify any organization or configuration of the information to be provided to the station devices, as I note above.

1265. In summary there is nothing in Vermani that discloses a common information portion of an uplink setup transmission with information that relates functionally to the total number of space time streams to be used in an UL MU transmission.

1266. Further, Dr. Hansen has not shown that Vermani is prior art to the 738 patent claims, which as I noted have a priority date of April 4, 2014.

11.5.5.10 Dependent Claims

1267. It does not appear that Dr. Hansen contends that Vermani meets these dependent claim limitations. Hansen Report at ¶¶2171-2345. Consequently, I will not address Limitations in claims 2-8 relative to Vermani, or the dependent Limitations in claims 10-16.

1268. Claim 9 has limitations similar to Claim 1, except it is written from the perspective of the station devices. Claim 9 has the same distinctions as Claim 1.

11.5.6 Chu Fails To Disclose Or Render Obvious Several '738 Claim Limitations

1269. The Chu patent was filed November 25, 2014, and issued November 21, 2017. As such, it is not prior art to the 738 patent, which as I explained above has a priority date of April 4, 2014. Dr. Hansen has not shown that Chu is entitled to an earlier priority date than its November 25, 2014 filing date.

[redacted]

1270. Chu discloses an uplink group definition frame that is transmitted to each member of the UL group, This frame includes an uplink MU MIMO transmission schedule for the client uplink group members to trigger them to transmit simultaneously to an access point.

1271. Figure 5 of Chu shows a DL sync signal transmitted from the AP, with the STAs responding with a UL MU MIMO transmission. The AP may then respond with a B-ACK:

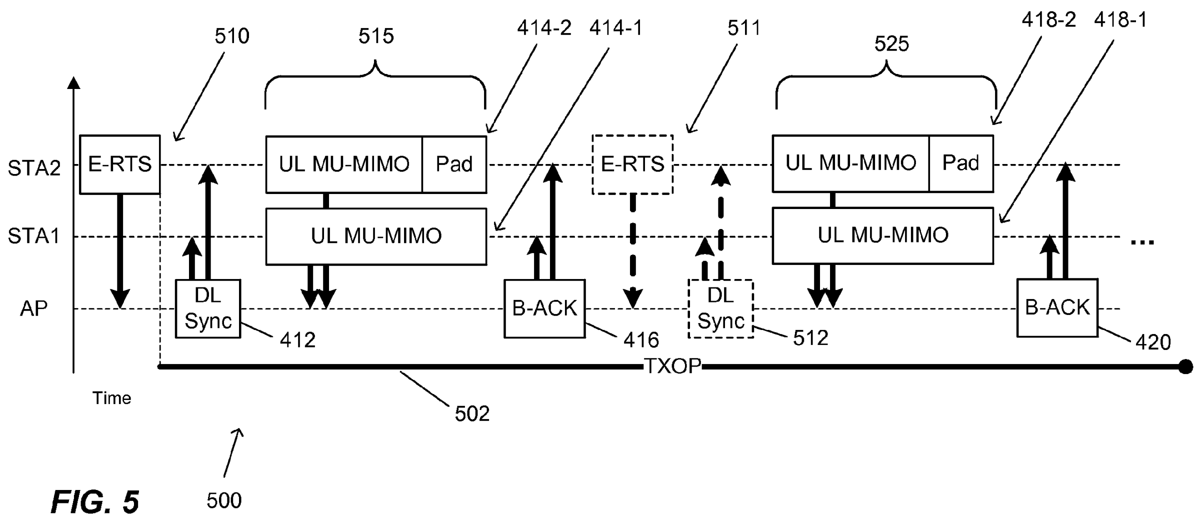


FIG. 5

1272. According to Chu, the STA sends a communication frame or management frame through an enhanced distributed channel access (EDCA) procedure. Chu at 6:2-10. The AP then transmits an uplink group definition frame through EDCA procedures or other medium access procedures. Chu at 6:15-17.

1273. Dr. Hansen has not clearly shown that Chu includes the limitations from the ’738 patent identified below.

11.5.6.1 Limitation 1d: transmitting downlink data and uplink setup information in a single physical downlink frame to a plurality of stations

1274. Claim 1 of the ‘738 Patent requires generating downlink data in Limitation 1b and then, relative to Limitation 1d, transmitting the downlink data together with uplink setup

[redacted]

information. Dr. Hansen states that Chu teaches Limitation 1d. Hansen Report at ¶2025-2029. I disagree.

1275. Dr. Hansen in ¶2025 block quotes Chu at 6:14-46, without any further explanation of how this passage relates to Limitation 1d. This same passage also was referenced for both Limitations 1b and 1c, also without explanation of which portions related to downlink data and which related to uplink setup information. This passage discusses an "uplink group definition frame" and identifies the type of information that frame provides, but it is not apparent which portions, if any, that Dr. Hansen is correlating to downlink data, for example.

1276. In his ¶2026, Dr. Hansen recites another block quote from Chu, again with no explanation. This block quote is from the next paragraph of Chu, at 6:47-67, which references Figure 2.

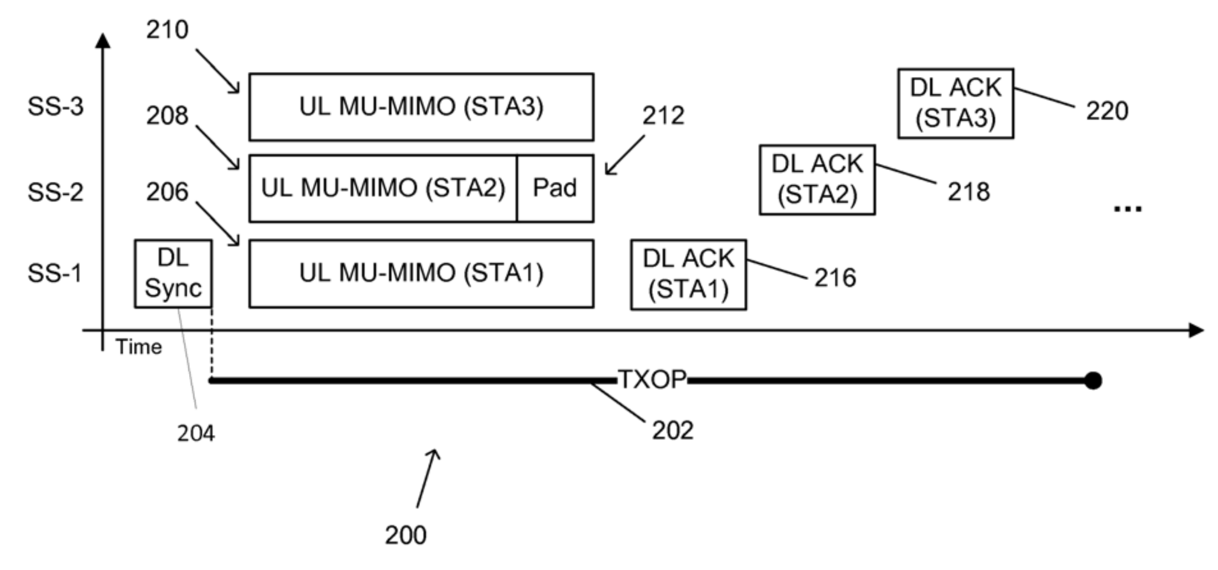


FIG. 2

1277. This passage from Chu states that "The AP generates and transmits a communication frame 204 that prompts STAI, STA2, and STA3 to transmit independent data simultaneously to the AP during the TXOP 202 of the AP." The only data referenced

[redacted]

in this passage relates to the uplink transmission, not the downlink transmission. The downlink transmission is simply referred to as a communication frame, without any indication of what information or data is to be included in this communication frame.

1278. Dr. Hansen also block quotes 8:42-56 from Chu. Hansen Invalidity Report at ¶2027. This passage describes Figure 4 of Chu:

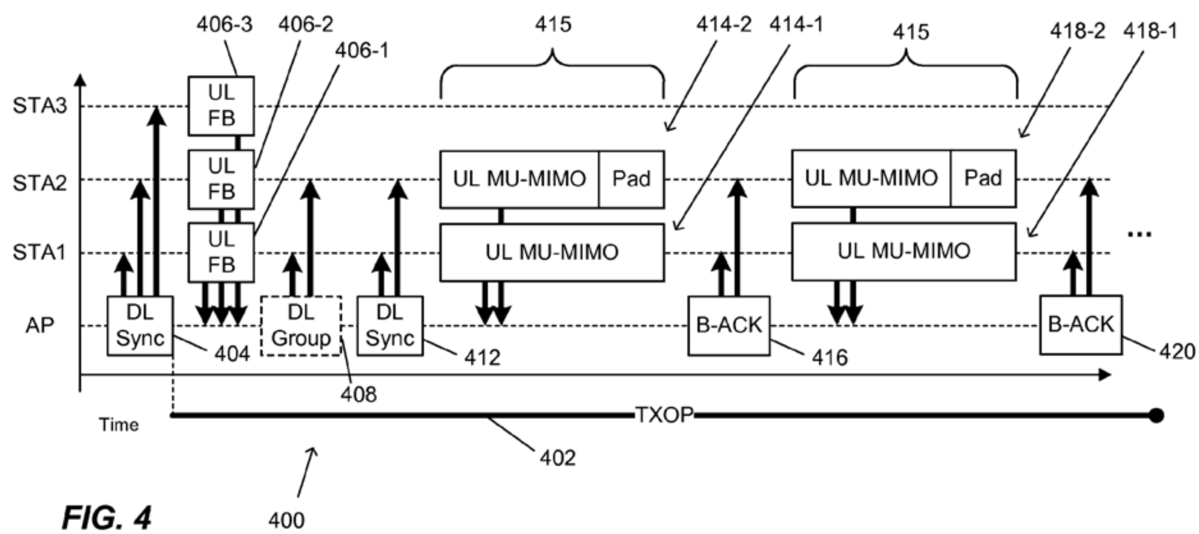


FIG. 4

1279. Chu in this passage refers to the polling communications frame (DL Sync) that an AP transmits to station devices. The only parameter identified in this passage is the duration field of the communication frame, which represents a value corresponding to a remaining duration of the TXOP 402 of the AP to protect subsequent transmissions in the TXOP. Dr, Hansen does not identify what aspect of Limitation 1d he contends this passage meets.

1280. Next, Dr, Hansen in ¶2028 block quotes Chu at 13:47-14:13, now referencing Figure 6. This passage again refers to a communication frame that correspond to a CTS-to-Self frame 610:

[redacted]

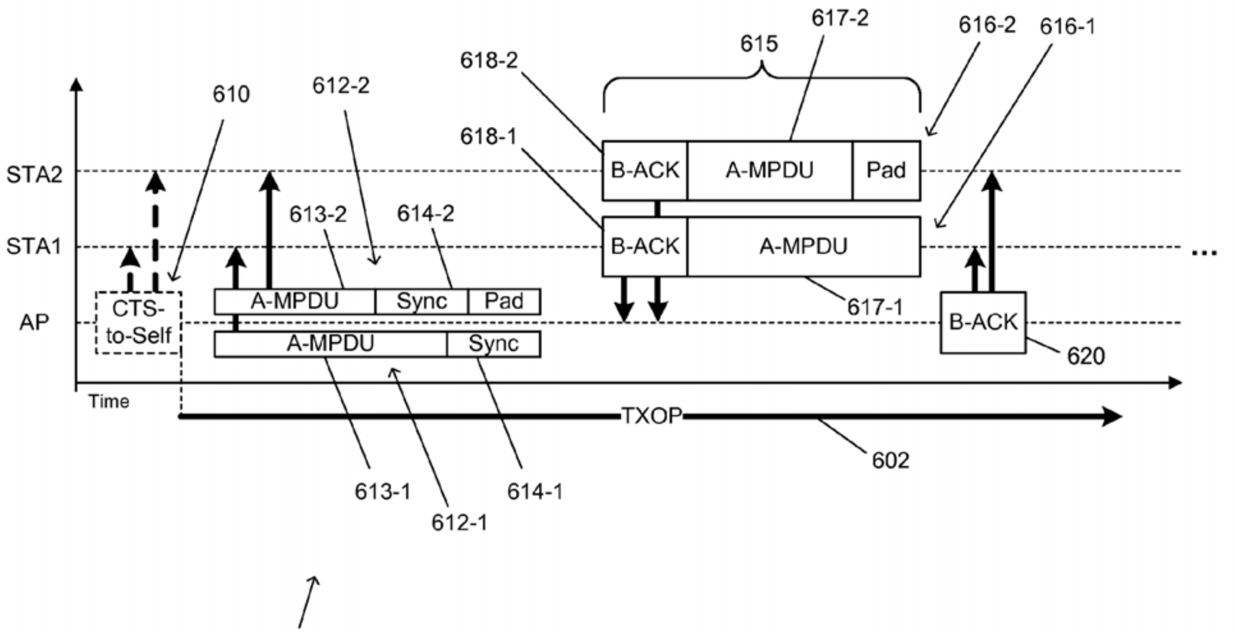


FIG. 6

1281. After the CTS-to-Self communication frame, the AP transmits DL data units 612 that include respective aggregate media access control protocol data units (A-MPDU) 613 and a communication signal 614. As was the case previously, Dr. Hansen does not explain which of these transmissions correlate to downlink data and which correspond to uplink setup information.

1282. In Summary, Dr. Hansen has not explained clearly exactly how he maps Chu to Limitation 1d. For these reasons, it is my opinion that Chu does not teach or suggest Limitation 1.

11.5.6.2 Limitation 1g: wherein the uplink setup information includes a common information portion and a dedicated information portion

1283. Claim 1 of the 738 patent requires that the uplink setup information is configured to include a common information portion and a dedicated information portion. Thus Claim 1 requires that the single physical downlink frame includes a specific organization, defining a common information portion and a dedicated user portion. Limitation 1g (together with Limitations 1h and 1i) capture that organization.

[redacted]

1284. Dr. Hansen states that Chu teaches Limitations 1g, h and i. Hansen Report at ¶2018-2115. I disagree. Hansen fails to identify or explain how Chu meets this specific organization recited in these claim limitations.

1285. While the excerpts from the Chu reference identify various parameters that are transmitted by an AP, there is nothing in Chu that indicates two discrete information portions defining a common field and a dedicated user-specific field. The block quotes from Chu do not clearly establish the sort of organization of common information and dedicated information that Claim 1 requires in limitations 1g, h and i. Further, Dr. Hansen does not explain how these parameters from Chu would have been organized to define these discrete information portions consistent with Limitations 1g, h and i.

11.5.6.3 Limitation 1j: wherein the second information is a function of a total number of space time streams to be used to transmit the multiple uplink frames

1286. Dr. Hansen asserts that Chu meets Limitation 1j of '738 Claim 1, block quoting from various passages of Chu. Report at ¶¶2152-2158. Dr. Hansen, however, never identifies which portion of the synchronization frame corresponds to a common information portion. I disagree that Chu discloses this Limitation 1j, and the passages quoted by Dr. Hansen do not support his conclusion that this limitation is met.

1287. In addition, none of the passages quoted by Dr. Hansen reference that a common information portion of an uplink setup frame provides information that relates functionally to the total number of space time streams for a responsive UL MU transmission.

1288. The only marginally relevant passage occurs at 7:14-17 of Chu which references a number of spatial streams, but that passage appears to refer to the number of streams assigned to a particular station, not the total number of streams to be used in the UL MU transmission by all of the solicited stations. And there is nothing to suggest that this information forms part of a common information portion of any uplink setup information.

1289. Further, this passage at 7:1-25 also is referenced by Dr. Hansen as satisfying the requirements of dependent claim 5 (¶2260), which requires that the dedicated information

[redacted]

identify the number of streams for a station. Clearly, the same information cannot form part of a common information portion while also forming part of a dedicated information portion.

1290. Dr. Hansen provides no explanation of the many excerpts he provides meets the claim limitations. He never identifies how this information defines a common information portion. Nor does he explain how the information relates functionally to a total number of space time streams to be used in the UL MU transmission from a plurality of stations.

1291. For these reasons, it is my opinion that Chu does not clearly meet Limitation 1j of the 738 patent.

11.5.6.4 Dependent Claims

1292. Claim 2 requires that the common information portion includes length information. As I noted above, Chu doesn't clearly demarcate what is common information and what is dedicated information in his downlink frame transmissions, and thus it does not satisfy the requirements of Claim 2. Dr. Hansen at ¶2185-2187 block quotes Chu but doesn't explain where or how a common information portion is identified in Chu.

1293. Claim 5 requires that the dedicated information portion includes identification information, information associated with the number of data streams for a particular STA, and MCS information. Dr, Hansen never clearly demarcates what is common information and what is dedicated information. Further, while I disagree that Chu discloses Limitation 1j, if it does, those same excerpts cannot also meet the requirements of Claim 5.

1294. Claims 9-16 include the same limitations as claims 1-8, and thus Chu also fails to meet the corresponding limitations from those claims.

11.5.7 Kang Fails To Disclose Or Render Obvious Several '738 Claim Limitations

1295. Kang is US Patent No. 9,794,032, with a PCT filing date of March 2, 2011 and issue date of October 17, 2017. The assignee of the patent is LG Electronics.

[redacted]

1296. Kang describes a wireless local area network in which an AP allocates a first transmission channel bandwidth to a first STA which is MIMO-paired with the AP. The AP also allocates a second transmission channel bandwidth to a second STA that also is MIMO-paired to the AP. The AP transmits to the STAs a sync trigger that determines the time during which the first STA will transmit a first PPDU and the time when the second STA will transmit a PPDU. *See* Kang Abstract.

1297. Dr. Hansen has not clearly established that Kang includes or discloses the limitations of the '738 patent identified below.

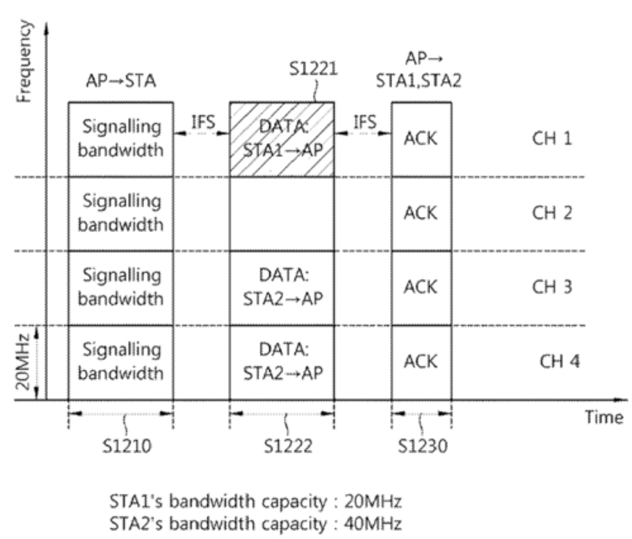
11.5.7.1 Limitation 1d: transmitting downlink data and uplink setup information in a single physical downlink frame to a plurality of stations

1298. Claim 1 of the '738 Patent requires generating downlink data in Limitation 1b and then, relative to Limitation 1d, transmitting the downlink data together with uplink setup information. Dr. Hansen states that Kang teaches Limitation 1d. Hansen Report at ¶2030-2036. I disagree.

1299. In ¶2031, Dr. Hansen refers to Kang at 12:40-44. This passage indicates that the AP performs signaling on a transmission channel bandwidth to be used for each of a plurality of STAs as shown in Kang Figure 12:

[redacted]

FIG. 12



1300. It is unclear if Dr. Hansen is referring to this signaling bandwidth information in this passage and Figure 12 as downlink data or uplink setup information, as he merely block quotes this passage without any explanation of how he is mapping this passage on the requirements of Limitation 1d. Regardless, it appears that Dr. Hansen is correlating this channel bandwidth information with only either uplink setup information or downlink data, but not both. Thus, if he contends that signaling bandwidth correlates to uplink setup information for example, he has not identified what in the quoted passage correlates to downlink data.

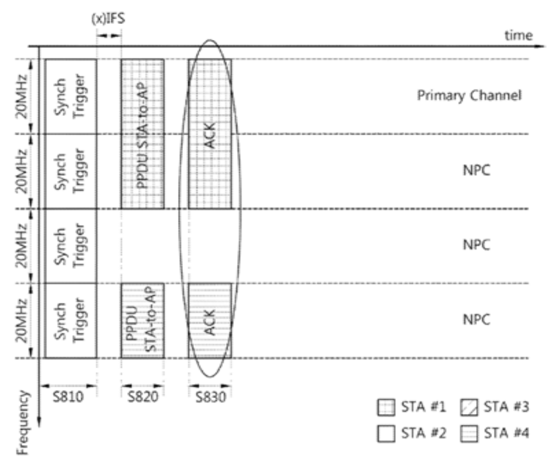
1301. Next, Dr. Hansen refers to Kang at 13:23-41, again without any explanation of how he maps that passage to the language of Limitation 1d. Hansen, ¶2032. This passage appears to indicate that transmission channel bandwidth information to be signaled to STAs may be included in a VHT-SIGB field (shown in Figure 4). Once again, Dr. Hansen does not explain how this passage correlates with the requirements of Limitation 1d. Specifically, he does not indicate what he contends correlates to either uplink setup information or downlink data relative to this passage in column 13.

[redacted]

1302. Dr. Hansen also refers to Figures 4, 8, 11, and 12 from Kang, *see* ¶2033, again without any explanation of how those figures correlate to the limitations of Claim 1d.

1303. In ¶2034, Kang block quotes the paragraph located in Kang at 11:34-46 without any explanation. This paragraph from Kang refers to the sync trigger shown in Figure 8.

FIG. 8



1304. It is unclear if Dr. Hansen is referring to this synch trigger in this passage and Figure 8 as downlink data or uplink setup information, as he merely block quotes this passage without any explanation of how he is mapping this passage on the requirements of Limitation 1d. Regardless, it appears that Dr. Hansen is correlating this sync trigger with only either uplink setup information or downlink data, but not both. Thus, if he contends that the sync trigger correlates to uplink setup information, for example, he has not identified what in the quoted passage correlates to downlink data.

1305. In addition, Dr. Hansen does not explain the relationship between the signaling bandwidth shown in Figure 12 and the sync trigger in Figure 8. To the extent that this sync trigger and signaling bandwidth comprise the same information, then these figures do not disclose both downlink data and uplink setup information. Stated differently, if both the sync trigger and signaling bandwidth correlate to uplink setup information, then Figures 8 and 12 do not disclose transmitting downlink data. *See also* Kang at column 12:16-32 (suggesting bandwidth information is sync triggering information)

[redacted]

1306. Conversely, if Dr. Hansen is suggesting that the sync trigger and signaling bandwidth represent both uplink setup information and downlink data – which he never clearly states – then Figure 8 only shows transmitting one of those values and Figure 12 also only shows transmitting one of those values. Thus, Figures 8 and 12 in combination would only indicate that one of those values are provided in a particular downlink transmission.

1307. Regardless, Dr. Hansen has not clearly explained how Kang's disclose related to Figures 8 and 12 would meet the requirements of Limitation 1d.

1308. In addition, the passage from Kang at 11:34-46 states that the sync trigger in Kang can be implemented as an RTS, CTS, CTS-to-self or as an uplink OFDM primitive frame.

> Synchronization triggering can be achieved by exchanging a request to send (RTS)/clear to send (CTS) defined in IEEE 802.11, transmitting a CTS-to-self frame, and transmitting an uplink OFDM primitive as a separate frame. Examples thereof will be described below in greater detail with reference to the accompanying drawings.

1309. The next passage block quoted by Dr. Hansen refers to the use of an OFDM primitive to convey a sync trigger. Hansen Report at ¶2035 (quoting Kang at 12:9-15). This appears to reflect that the sync trigger may be provided in various types of control frames.

1310. Based on the foregoing, Dr. Hansen has not clearly defined what information he contends correlates to transmitting downlink data and uplink setup information in a single physical downlink frame, and thus he has not shown this Limitation 1d is met by Kang.

11.5.7.2 Limitation 1g: wherein the uplink setup information includes a common information portion and a dedicated information portion

1311. Claim 1 of the 738 patent requires that the uplink setup information is configured to include a common information portion and a dedicated information portion. Thus Claim 1 requires that the single physical downlink frame is organized with a specific organization,

[redacted]

defining a common information portion and a dedicated user portion. Limitation 1g (together with Limitations 1h and 1i) capture that organization.

1312. Dr. Hansen states that Kang teaches Limitations 1g, h and i. Hansen Report at ¶2116-2123. I disagree. Hansen fails to identify or explain how Kang meets this specific organization of an uplink setup information recited in these claim limitations.

1313. The passages from Kang quoted by Dr. Hansen relate generally to the form of PPDU's that are transmitted generically in a WLAN. In ¶2117, Dr. Hansen block quotes Kang at 8:3-36. This information relates to Figure 3, which identifies the number of HE-LTF fields to include in a downlink transmission. Further, this passage indicates that "[e]xamples of control information additionally required for the VHT WLAN system may be information indicating the number of spatial streams ***to be received by each STA***, information regarding modulation and coding of data ***transmitted to each STA***, etc." Kang 8:20-25. This information relates to a downlink transmission that is received by the STAs, and not uplink setup information that is to be used for subsequent uplink multi-user transmissions. There is nothing in the cited passage that indicates that this control information is uplink setup information.

1314. The other quoted passages from Kang similarly relate to downlink transmission received by STAs, and not uplink setup information. The passage cited in Hansen's ¶2118 (8:37-9"4 of Kang) refers to the format of a PPDU used in the WLAN system supporting MU-MIMO. This passage, and the information fields identified in this passage, are never correlated or tied to an uplink setup frame. For example, the passage refers to the VHT-SIGA field and notes that this field "includes information for interpreting the ***received PPDU*** 400 as common control information required for VHT-STAs." Kang at 8:59-62. In other words, the VHT STA receives a PPDU from an AP and uses the control information provided in the VHT-SIGA field to interpret the received PPDU. This passage has nothing to do with uplink setup information that is to be used for a subsequent uplink multi-user transmission.

[redacted]

1315. The Kang passage at 9:14-30, which Dr. Hansen cites at ¶2119, also relates solely to a downlink transmission, and provides no information with regard to uplink setup information. This passage refers to the VHT-SIGB field and it states that "the VHT-SIGB field 470 is decoded only when the common control information included in the VHT-SIGB field 470 indicates that the ***currently received PPDU*** 400 is transmitted using MU-MIMO transmission." 9:16-21; *see also* 9:14-16 ("VHT-SIGB field 470 includes dedicated control information required when the plurality of MIMO-paired STAs ***receive the PPDU 400 to acquire data***."). Thus, according to this quoted passage, the VHT-SIGB field is decoded and used to interpret the received PPDU when the currently received PPDU is a DL MU-MIMO transmission. Further, the VHT-SIGB field is not decoded at all if the DL transmission is only for a single user. Clearly, this passage is only referencing decoding a DL MU transmission, and not providing setup information for a uplink multi-user transmission.

1316. Dr. Hansen provides zero explanation of the quoted passages from Kang, nor does he indicate why this information related to decoding downlink transmissions has any impact regarding the claimed uplink setup information.

1317. While the excerpts from the Kang reference mention common and dedicated control information in a SIGA/SIGB preamble field, the transmissions described only relate to decoding downlink transmission, and not providing uplink setup information for an uplink multi-user transmission.

1318. The other quotes from 6:4-5 and 7:45-48 relate generally to formats of PPDUs and thus are not of any particular relevance to the Limitations 1g, h and i.

1319. Thus, the block quotes from Kang do not clearly establish the sort of organization of common information and dedicated information for ***uplink setup information*** that Claim 1 requires in limitations 1g, h and i. Further, Dr. Hansen does not explain how the VHT-SIGA and VHT-SIGB fields described in the passages he cited in Kang have any bearing or relevance to uplink setup information recited in Limitations 1g, h and i.

[redacted]

11.5.7.3 Limitation 1j: wherein the second information is a function of a total number of space time streams to be used to transmit the multiple uplink frames

1320. Dr. Hansen asserts that Kang meets Limitation 1j of '738 Claim 1, block quoting from various passages of Kang. Report at ¶¶2160-2164. Dr. Hansen, however, never identifies which portion of the synch frame corresponds to a common information portion of uplink setup information. I disagree that Kang discloses this Limitation 1j, and the passages quoted by Dr. Hansen do not support his conclusion that this limitation is met.

1321. Limitation 1j of the '738 patent requires that the claimed information is a function of the ***total number of space time streams to be used to transmit the multiple uplink frames***. The passages block quoted do not establish that Kang discloses anything regarding (i) uplink setup information; (ii) common information that forms part of an uplink setup information; (iii) information that is a function of a total number of space time streams; and (iv) where the total number of space time streams are used to transmit an uplink multi-user transmission. The disclosure in Kang relates to the number of streams per station; is not in a common information portion of uplink setup information; and does not reflect anything regarding the total number of streams to be used to transmit multiple uplink frames.

1322. Dr. Hansen again block quotes Kang at 8:3-36. This information relates to Figure 3, which identifies the number of HE-LTF fields to include in a ***downlink transmission*** to decode the downlink transmission. This passage states that "[e]xamples of control information additionally required for the VHT WLAN system may be information indicating the number of spatial streams ***to be received by each STA***, information regarding modulation and coding of data ***transmitted to each STA***, etc." Kang 8:20-25. The information described in this passage clearly relates only to a ***downlink transmission that is received by a STA***, and not uplink setup information that is to be used for a subsequent uplink multi-user transmission. There is nothing in the cited passage that indicates that this control information is uplink setup information.

[redacted]

1323. In addition to defining only downlink transmission parameters, the information regarding spatial streams is not common information, but is instead user-specific information. The relevant passage states that "[e]xamples of control information … may be information indicating the number of spatial streams to be received ***by each STA***. Kang at 8:20-25. The spatial streams referred to here, in addition to being related to downlink transmissions, reflects the number of streams on a per STA basis.

1324. In addition, the number of spatial streams described in Kang only refers to the number of streams transmitted to one station as part of a downlink transmission, not the total number of streams to be used in an uplink multi-user transmission.

1325. The passage of Kang cited in ¶2162 does not solve any of these deficiencies in the passage discussed above. This passage simply indicates that VHT-LTF fields in a downlink transmission are used by the STA to estimate a MIMO channel, and the VHT-LTF field is configured based on the number of spatial streams in which a PPDU is transmitted. This passage does not refer to uplink setup information, a common information field, any uplink multi-user transmission or the total number of space-time streams used in an uplink multi-user transmission.

1326. The quotes form the Kang reference have no relevance to Limitation 1j, and fails to disclose (i) uplink setup information; (ii) common information that forms part of uplink setup information; (iii) any information that is a function of a total number of space time streams; and (iv) where the total number of space time streams are used to transmit an uplink multi-user transmission.

11.5.7.4 Dependent Claims

1327. Claim 2 of the '738 patent Each of the independent claims of the '738 Patent requires that the common information portion includes a length information associated with a length of the multiple uplink frames.

[redacted]

1328. Dr. Hansen contends this limitation is met in ¶¶2189-2196. None of the block quotes in these paragraphs ever mention length information of multiple uplink frames, nor do they relate to the common information portion of uplink setup information.

1329. At most, the quote in ¶2190-2191 refers to common information, but this is common information provided for decoding downlink transmission, and not information that forms part of setup information for a multi-user uplink transmission. The quotes in ¶¶2194-2195 refer to PPDU formats and contain nothing relevant to claim 2.

1330. Hansen at ¶2193 quotes a passage from Kang that refers to bandwidth indication information, but there is no indication that this part of a common information field, nor is a bandwidth indication related in any way to the length of multiple uplink frames.

1331. For these reasons, Dr. Hansen has not shown that Claim 2 is met by Kang. Claims 3 and 4 depend on Claim 2, and thus the same issues exist with regard to those claims. Relative to claims 3 and 4, Dr. Hansen again provides information relative to PPDU formats, without any discussion of a length specified in a common information portion of uplink setup information to define a length of a multi-user uplink frame.

1332. For claim 5, Dr. Hansen references the same passages related to downlink transmission from an AP to STA's, and provides no evidence that the specific claimed parameters are provided in a dedicated information portion of uplink setup information. *See* Hansen at ¶2263-2265. The spatial streams and MCS information portions identified by Dr. Hansen are provided for decoding a downlink transmissions, and not for defining an uplink multi-user frame.

1333. For these reasons, it is my opinion that Dr. Hansen has not clearly established that Kang teaches the Limitations I identify above relative to Claim 1. Further, Dr. Hansen has not clearly established that Hansen teaches the Limitations of Claims 2-5. Claim 9 is similar to Claim 1, and thus Dr. Hansen's reliance on Kang contains similar deficiencies as I identified for Claim 1. Claim 10-13 are similar to claims 2-5, and thus the quoted portions of Kang have the same issues relative to those claims.

[redacted]

11.5.8 Gong Fails To Disclose Or Render Obvious Several '738 Claim Limitations

1334. Gong discloses the format of a group action frame in Figure 1. *See* Gong at [0014]. The responsive frame is shown in Figure 2 and described in paragraph [0015].

1335. Dr. Hansen has not clearly established that Gong discloses the following limitations from the '738 patent.

11.5.8.1 Limitation 1b: generating downlink data

1336. Limitation 1b requires that the AP generate downlink data. This downlink data then is transmitted in the same physical downlink frame as the uplink setup information in Limitation 1d. Dr. Hansen states that Gong meets Limitation in his ¶1964. He then block quotes paragraphs [0011] and [0013] from Gong in his ¶¶1965-1966. But Dr. Hansen does not explain how any of his quotes constitute generating downlink data pursuant to Limitation 1b.

1337. Paragraph [0011] of Gong refers to using MAC signaling to notify STAs regarding various parameters, including multicast address, total number of streams and rows of a P matrix, and MCS information. Paragraph [0013] of Gong refers to the action frame transmitted by the AP to multiple STAs. Dr. Hansen does not explain which of this information constitutes downlink data. Further, Dr. Hansen appears to refer to each of these parameters as satisfying specific requirements of the claimed uplink setup information. *See* Hansen Report at ¶¶1995-2000 (Limitation 1c); ¶¶2124-2127 (Limitations g-i); ¶¶2197-2198 (Claim 2); ¶¶2267-2269 (Claim 5). Dr. Hansen does not identify which parameters in these paragraphs are downlink data, and elsewhere he appears to refer to these parameters as forming part of the uplink setup information.

1338. For Limitation 1c which claims generating uplink setup information, Dr. Hansen also quotes paragraph [0013] (referring to the action frame). ¶1996. He also quotes Gong [0014], which identifies the same parameters as [0011] – multicast address, total number of streams and stream bitmap field, and MCS information. ¶1997. Dr. Hansen also quotes Gong [0017] which again refers to the parameters in [0011], including MCS, row of P

[redacted]

matrix assigned to STAs. ¶1998. In the next paragraph (¶1999), Dr. Hansen block quotes Gong [0018] which describes the rows in the P matrix using a stream bitmap field and the action frame referenced in Gong [0011] and [0013]. Similarly, for Limitations 1g-I, Dr. Hansen again references Gong [0014] and [0017], which identify as uplink setup information the same parameters he identifies for the downlink data. *See* Hansen Report at ¶2125-2126.

1339. For Claim 2, Dr. Hansen block quotes [0014], which refers to the action frame and identifies the same parameters referenced in Gong [0011]. *See* Hansen Report at ¶2198. For claim 5, Dr. Hansen refers to Claim 2 of Gong, but that claim includes the same information as was recited in [0011], including multicast address, total number of streams MCS and rows of P matrix.

1340. In summary, Dr. Hansen does not identify what information constitutes downlink data in the passages he block quotes for Limitation 1b. Further, Dr. Hansen refers to the same information appearing in these quoted claimed passages [0011] and [0013] as satisfying the uplink setup information requirements. As a result, it is unclear what portions of these block quotes correlate to the claimed downlink data required in Limitation 1b

1341. For these reasons, it is my opinion that Gong does not teach or suggest Limitation 1b.

11.5.8.2 Limitation 1d: transmitting downlink data and uplink setup information in a single physical downlink frame to a plurality of stations

1342. Claim 1 of the '738 Patent requires, relative to Limitation 1d, transmitting the downlink data together with uplink setup information. Dr. Hansen states that Gong teaches Limitation 1d. Hansen Report at ¶2037-2040. I disagree for the reasons noted above relative to Limitation 1b. Dr. Hansen has failed to identify anything relative to Limitation 1d that constitutes downlink data.

1343. For Limitation 1c, Dr. Hansen quoted Gong paragraphs [0014], [0017], and [0018] as showing uplink setup information. ¶¶1997-1999. For this Limitation 1d, which requires

[redacted]

transmitting downlink data and uplink setup information, Dr. Hansen quotes paragraphs [0014], [0017] and [0018] – the exact same paragraphs quoted for the uplink setup information recited in Limitation 1c. Hansen report at ¶¶2038-2040. Dr. Hansen provides no explanation of what information in Gong paragraphs [0014], [0017] and [0018] constitutes downlink data.

1344. Gong [0014], referenced in ¶2038, refers to a group action frame. This frame contains the multicast address, the total number of streams, the max duration of the A-MPDUs in the UL MU MIMO transmission, AIDs of STAs in the group, MCS, and optionally a stream bitmap field. Dr. Hansen does not identify what information within the group action frame constitutes downlink data. But as I noted above regarding Limitation 1b, he identifies all of these parameters as satisfying requirements of uplink setup information in other claim limitations. Dr. Hansen has not clearly shown that any of the identified parameters in Gong [0014] correlate to downlink data.

1345. Next, Dr. Hansen block quotes Gong [0017]. Hansen ¶ 2039. This passage quoted from Gong refers to the uplink transmission from STAs. It also again references MCS, spatial streams used by particular STAs, and P matrix row assignments. Dr Hansen does not identify anything in this quoted passage that correlates to downlink data. And as I've noted above and relative to Limitation 1b, Dr. Hansen has identified this information for other requirements of the claimed uplink setup information. *See* Hansen Report at ¶¶1995-2000 (Limitation 1c); ¶¶2124-2127 (Limitations g-i); ¶¶2197-2198 (Claim 2); ¶¶2267-2269 (Claim 5).

1346. In Hansen ¶ 2040, he block quotes Gong [0018]. This paragraph of Gong provides information regarding the manner in which rows of the mapping P matrix are assigned, either based on the order of the AIDs or a stream bitmap field. This paragraph also mentions the group action frame, which may be transmitted as a CF-Poll frame to the multicast address or as a broadcast frame. Dr. Hansen does not identify any information in this paragraph that correlates to downlink data. Further, as noted above, Dr. Hansen also

[redacted]

references this same information relative to other requirements of the uplink setup information. *See* Hansen Report at ¶¶1995-2000 (Limitation 1c); ¶¶2124-2127 (Limitations g-i); ¶¶2197-2198 (Claim 2); ¶¶2267-2269 (Claim 5)

1347. Based on the foregoing, Dr. Hansen has not clearly identified what information in the passages he block quotes correlates to downlink data in a downlink transmission that includes uplink setup information, as required in Limitation 1d.

11.5.8.3 Limitation 1f: transmitting an acknowledgment frame to the multiple stations after successful reception of the multiple uplink frames

1348. Dr. Hansen has not shown that Gong discloses Limitation 1f. For these reasons, it is my opinion that Gong does not teach or suggest Limitation 2. *See* Hansen Report at ¶2093-2096.

1349. Dr. Hansen block quotes paragraph [0018] and Claim 21 of Gong. Hansen Report at ¶2093-2094. Neither mention acknowledgement frames. In paragraph [0018] Gong only indicates that the AP will process preambles from all STAs, and does not identify any responsive communication from the AP after transmission of the group action frame, much less an ACK frame of the multiple uplink frames. Claim 21 is similar to paragraph [0018], and does not identify any responsive transmission from the AP after the uplink transmission.

1350. Dr. Hansen has not shown that Limitation 1f of the '738 patent is clearly satisfied by Gong.

11.5.8.4 Limitation 1g: wherein the uplink setup information includes a common information portion and a dedicated information portion

1351. Claim 1 of the 738 patent requires that the uplink setup information is configured to include a common information portion and a dedicated information portion. Thus Claim 1 requires that the single physical downlink frame includes a specific organization, defining a common information portion and a dedicated user portion. Limitation 1g (together with Limitations 1h and 1i) capture that organization.

[redacted]

1352. Dr. Hansen states that Gong teaches Limitations 1g, h and i. Hansen Report at ¶2124-2128. I disagree. Hansen fails to identify or explain how Gong meets this specific organization recited in these claim limitations.

1353. While the block-quoted excerpts from Gong identify various parameters that are transmitted by an AP in an action frame, there is nothing in Gong that indicates two discrete information portions defining a common field and a dedicated user-specific field. For example, the block quotes from Gong do not clearly establish the sort of organization of common information that Claim 1 requires in limitations 1g and 1h. Further, Dr. Hansen does not explain how the parameters from Gong would have been organized to define a common information portion consistent with Limitations 1g and 1h.

11.5.8.5 Limitation 1j: wherein the second information is a function of a total number of space time streams to be used to transmit the multiple uplink frames

1354. Dr. Hansen asserts that Gong meets Limitation 1j of '738 Claim 1, block quoting from various passages of Gong. Report at ¶¶2165-2169. I disagree that Gong discloses this Limitation 1j, and the passages quoted by Dr. Hansen do not support his conclusion that this limitation is met.

1355. In Gong paragraph [0014], Gong provides an example frame format of an UL MU MIMO group action frame as shown in Figure 1. Nothing in this passage identifies a common information portion of the group action frame. Dr. Hansen never identifies or explains which portion of the action frame corresponds to a common information portion of uplink setup information. Thus, Gong does not clearly meet Limitation j for at least this reason.

1356. In addition, while Figure 1 shows a field that is identified as Total # of streams, it is not entirely clear if this field is referring to the total number of streams that are ***available*** for an UL MU transmission, or if this field refers to the total number of streams that are to be *used* to transmit the multiple uplink frames. This is the same issue that I discussed

[redacted]

above relative to the Zhang reference, which also was addressed in the ’738 prosecution history. Figure 1 of Gong is shown below:

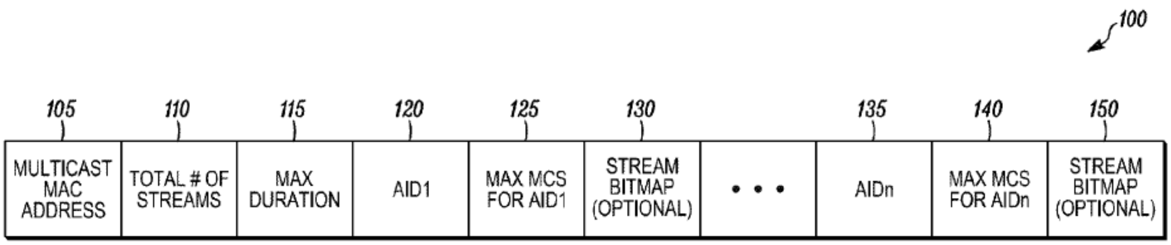


FIG. 1

1357. In paragraph [0014], Gong refers to “the total number of streams 110 within an UL MU MIMO transmission,” but it is not entirely clear if this refers to the total number of available streams within an UL transmission, or the actual total number of streams that will be used. Further clouding this issue is Gong’s disclosure that, according to the embodiments of the present invention as described in [0015], the UL MU MIMO transmission also identifies the total number of streams, as shown in field 205 of Figure 2.

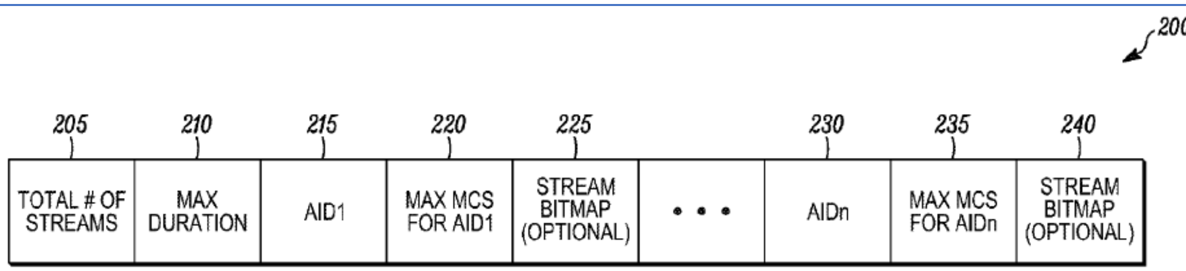


FIG. 2

1358. If the AP dictates the total number of streams that will be used in the UL MU transmission (and the number of streams to be used by each STA), then it would be unnecessary for the STAs to repeat that information in an UL transmission because the AP already would know that information. Relative to field 205 in Figure 2, Gong states that “an example frame format of an UL MU MIMO frame … may contain the total number of streams 205 within an UL MU MIMO transmission.” Gong at [0015]. This raises the

[redacted]

question of whether the STAs have discretion to use less than the allotted number of streams, so that the value identified by the AP as the total number of streams refers to the streams that are available, and not the actual number to be used.

1359. The inclusion of the total number of streams in the UL frame, therefore, without further explanation from Gong, raises questions regarding whether the total number of frames identified in Figure 1 refers to the actual number of streams to be used or whether it indicates the total number of streams that may be used, with the STAs having discretion to determine the number of streams to use.

1360. In light of this uncertainty, and because neither Dr. Hansen nor Gong provide further explanation of what is intended by Gong's reference to the total number of streams, in my opinion Gong does not clearly meet the requirements of Limitation 1j for this additional reason.

11.5.8.6 Dependent Claims

1361. Claims 6 and 7 both recite additional requirements relative to acknowledgment frames. Because Gong is entirely silent regarding the transmission of an acknowledgment frame by an AP after successful receipt of an UL MU transmission, it follows that Gong does not meet the requirements of claims 6 and 7.

1362. Dr. Hansen again cites [0018] and Claim 21 (Report at ¶¶2295-2296; 2322-2323) of Gong relative to claims 6 and 7, but as I noted above relative to Limitation 1f, Gong does not disclose anything regarding acknowledgement frames in those passages.

1363. For these reasons, it is my opinion that Dr. Hansen has not clearly established that Gong teaches the Limitations I identify above relative to Claim 1. Further, Dr. Hansen has not clearly established that Hansen teaches the Limitations of Claims 6 and 7. Claim 9 is similar to Claim 1, and thus Dr. Hansen's reliance on Gong contains similar deficiencies as I identified for Claim 1. Claims 14-15 are similar to claims 6-7, and thus the quoted portions of Gong have the same issues relative to those claims.

[redacted]

11.5.9 Dr. Hansen's Alleged '738 Prior Art—Even Collectively—Fails To Teach or Suggest Several '738 Claim Limitations, So Any Combination Fails To Render Obvious the '738 Claims

1364. This chart summarizes my '738 validity analysis that is detailed above. The rows correspond to a shorthand summary of the '738 claim language, and the columns correspond to Dr. Hansen's eight references for the '738 Patent: (1) Merlin 258, (2) Yuan, (3) Zhang, (4) Merlin 690, (5) Vermani, (6) Chu, (7) Kang and (8) Gong. In instances in which I concluded that one of Dr. Hansen's references did not teach or suggest a claim limitation, I placed a red "X" at the row/column intersection. (The absence of a red "X" does not mean that I necessarily agree the reference teaches or suggests the claim limitation). I also identify the references with an X which have not been shown to be prior art to the '738 patent, based on its April 4, 2014 priority date.

'738 Claim Language Shorthand	**Merlin '258**	**Yuan**	**Zhang**	**Merlin 690**	**Vermani**	**Chu**	**Kang**	**Gong**
Prior Art	**X**			**X**	**X**	**X**		
[1a] a method of operating an access point in wireless network								
[1b] generating downlink data					X			X
[1c] generating uplink setup information including 1st information to be used for UL MU transmission		X		X	X			
[1d] transmitting downlink data and uplink setup information in a single physical downlink frame to a plurality of STAs	X	X	X	X	X	X	X	X
[1e] simultaneously receive MU UL frames from multiple STAs		X		X	X			
[1f] transmitting an ACK frame to multiple STAs after successful MU UL frames		X		X	X			X
[1g] wherein uplink setup information includes a	X	X	X	X	X	X	X	X

[redacted]

'738 Claim Language Shorthand	Merlin '258	Yuan	Zhang	Merlin 690	Vermani	Chu	Kang	Gong
Prior Art	**X**			**X**	**X**	**X**		
common portion and a dedicated portion								
[1h] common information includes 2nd information common to plurality of STAs	X	X	X	X	X	X	X	X
[1i]dedicated information includes 3rd information specific to each of plurality of stations to receive uplink setup information		X		X	X	X	X	
[1j] wherein 2nd information is a function of total number of space time streams to be used to transmit the multiple uplink frames	X	X	X	X	X	X	X	X
[2] wherein common information includes length information associated with length of MU UL frames		X		X		X	X	
[3] wherein respective lengths of MU UL frames are identical to transmission length		X		X			X	
[4] one or more MU UL frames include padding bits		X		X			X	
[5] wherein dedicated information portion includes STA ID information, information associated with number of data streams and MCS		X		X		X	X	
[6] wherein ACK frame includes acknowledgment information for one or		X		X				X

[redacted]

'738 Claim Language Shorthand	**Merlin '258**	**Yuan**	**Zhang**	**Merlin 690**	**Vermani**	**Chu**	**Kang**	**Gong**
Prior Art	**X**			**X**	**X**	**X**		
more of plurality of STAs								
[7] SIFS between uplink setup and MU UL frames and between MU UL frames and ACK frame	X	X	X	X				X
[8]wherein MU UL frames are transmitted by multiple STAs using MU-MIMO		X		X				

1365. As reflected in the Table above, Dr. Hansen has not clearly shown that any of the asserted references disclose '738 claim limitations 1[d], 1[g]/1[h] and 1[j]. Consequently, Dr. Hansen's alleged '738 prior art—even collectively, or any in combination thereof—fails to teach or suggest every limitation of the '738 claims. Hence, I understand that Dr. Hansen's '738 art cannot render obvious the '738 claims as a matter of law.

11.5.9.1 A POSITA Would Not Have Combined Merlin 258, Yuan, Zhang, Merlin 690, Vermani, Chu, Kang and and/or Gong

1366. Dr. Hansen alleges that a POSITA would have been motivated to make any combination of Merlin 258, Yuan, Zhang, Merlin 690, Vermani, Chu, Kang and Gong. Hansen Report at ¶¶1861, 2380, 2392. I disagree. Even assuming for the sake of argument that my analysis above is incorrect and there is some combination of these eight different references that discloses every limitation of the '738 claims, it would not have been obvious for a POSITA to have combined those references as recited in the claims in April 2014.

1367. In addition, I note that for four of the eight references identified for the '738 patent by Dr. Hansen, he has not shown they are entitled to a priority prior art to the April 4 priority date of the '738 patent. This includes the Merlin 258 published patent application, which is the primary reference asserted by Dr. Hansen in all but one of his exemplary combinations. Hansen Report at ¶2393-2401. The only instance where Dr. Hansen does

[redacted]

not identify Merlin 258 reference as his primary reference is with regard to the exemplary combination identified in Hansen ¶2400. This exemplary combination, however, refers to Chu, which also has not been shown to be prior art to the ’738 patent. Merlin 690 and Vermani also have not been shown to be prior art. Thus, of the references that appear to be directed to the development of 802.11ax (Merlin 258, Merlin 690, Vermani and Chu), none of those references have been shown to be prior to the ’738 patent.

1368. There is no apparent reason—apart from improper hindsight—that would have motivated a POSITA to combine together Merlin 258, Yuan, Zhang, Merlin 690, Vermani, Chu, Kang and Gong. Vermani, Merlin 258, and Merlin 690 are Qualcomm published patent applications filed in July, August and October 2014. Yuan is a published ZTE patent application filed in January 2013. Zhang and Chu are Marvell patents filed in July 2010 and November 2014. Kang is a patent owned by LG Electronics that was filed March 2, 2011. Finally, Gong is a published patent application filed July 28, 2010. Thus these 8 different references originate from five different corporations.

1369. Further, Dr. Hansen’s ‘738 references relate to different concepts and technologies. The Qualcomm references all are directed to uplink multi-user transmissions, and they appear directed to development work for the 802.11ax (High Efficiency) standard. *See* Merlin 258 at [0002], [0056]; Merlin ‘690 at [0003], [0126]; Vermani at [0003], [0111]. Like the Merlin and Vermani references, Chu also is directed to WLANs that use multiple input multiple output techniques, and appears to relate to development efforts for what became the 802.11ax standard. *See e.g.* Chu at 1:16-18; 1:34-38. As I’ve noted, none of these references have been shown to be prior art to the ’738 patent.

1370. Yuan, conversely describes a “physical downlink control channel multiplexing” for cellular communications, consistent with 3GPP LTE standards. Yuan at [0001], [0003]. Thus, contrary to the ’738 patent, Yuan is directed to proposed improvements to a cellular standard, and implements techniques that would not have been compatible with the 802.11 standard, and which never have been implemented in the 802.11 standard. Further details

[redacted]

on the Yuan reference are noted in my section above addressed specifically to Yuan in Section 11.5.2, incorporated herein by reference.

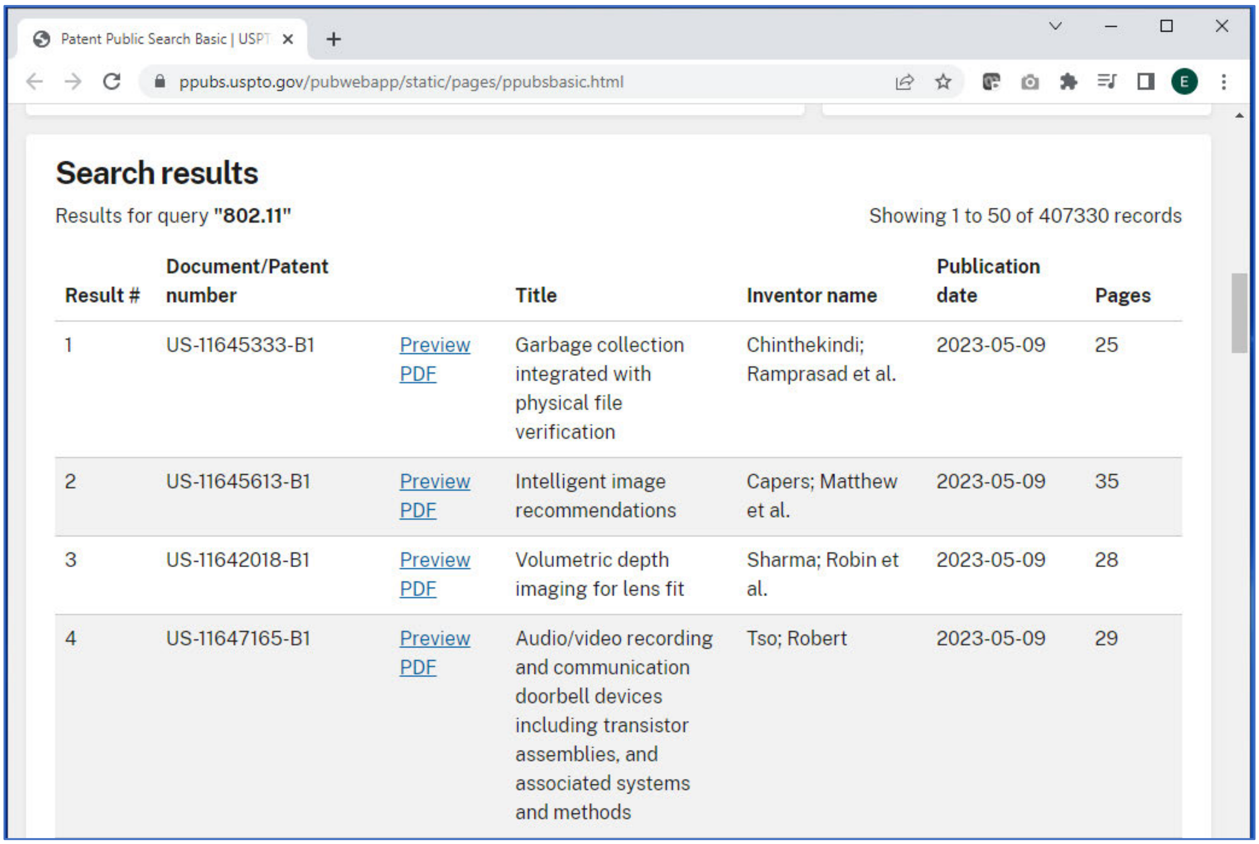
1371. Zhang relates to "multiple-input, multiple output (MIMO) wireless local area networks, such as those covered in 802.11ac. Zhang at 1:26-28; 2:54-64; 3:8-15;8:40-49 (referring to Very High Throughput signaling). The VHT extensions to 802.11 that were included in 802.11ac provided support for multi-user downlink transmissions, but not multi-user uplink transmissions. Kang and Gong also appear directed to 802.11ac systems. Kang at 2:8-16, Figure 4; Gong at [0001]. Zhang, Kang and Gong thus all are directed to 802.11ac Very Hight Throughput systems, and not the High Efficiency extensions that were adopted in 802.11ax.

1372. Thus, these three different groups of references address different problems and issues, different versions of the 802.11 standard, and at least relative to Yuan, an entirely different communication standard altogether – a cellular network instead of a wireless local area network. Dr. Hansen has not shown that a POSITA would have been motivated to combine these teachings. The inventors developing concepts related to 802.11ax were uniquely positioned to determine which concepts from the prior 802.11 standards to incorporate into their inventions. Suggesting that it would have been obvious to modify the inventions of Merlin, Vermani and Chu by mixing and matching concepts from work on earlier standards involves hindsight, by cherry-picking the many concepts that were proposed in prior versions of the standard, but at least in some instances, not adopted. I understand using hindsight to reconstruct the claimed invention is improper, and that it is necessary to determine obviousness independently based on the state of the art and the teachings contained in the prior art itself.

1373. Dr. Hansen's section related to motivation to combine these eight references is superficial and does not explain why these specific references would have been selected to be combined together from among the myriad of materials that existed relative to wireless communications, and especially 802.11. Dr. Hansen states that each of his '738 references

[redacted]

are "analogous art" because, like the '738 Patent, most relate to WLAN operation according to IEEE 802.11 standards. Hansen Report at ¶2381. The lengthy block quotes from the 802.11 references only serves to show that these references are directed to a version of the 802.11 standard. Yet even Dr. Hansen concedes, "Yuan does not specifically refer to 802.11 standards; rather, Yuan discusses wireless cellular technology." ¶2382. Notwithstanding, just because references relate to 802.11 standards does not mean a POSITA would have combined them. A search of the USPTO patent database reveals there are 407,330 patents that mention "802.11."


Patent Public Search Basic | USPT

ppubs.uspto.gov/pubwebapp/static/pages/ppubsbasic.html

Search results

Results for query **"802.11"** Showing 1 to 50 of 407330 records

Result #	Document/Patent number		Title	Inventor name	Publication date	Pages
1	US-11645333-B1	Preview PDF	Garbage collection integrated with physical file verification	Chinthekindi; Ramprasad et al.	2023-05-09	25
2	US-11645613-B1	Preview PDF	Intelligent image recommendations	Capers; Matthew et al.	2023-05-09	35
3	US-11642018-B1	Preview PDF	Volumetric depth imaging for lens fit	Sharma; Robin et al.	2023-05-09	28
4	US-11647165-B1	Preview PDF	Audio/video recording and communication doorbell devices including transistor assemblies, and associated systems and methods	Tso; Robert	2023-05-09	29

https://ppubs.uspto.gov/pubwebapp/static/pages/ppubsbasic.html. Using this logic, a POSITA would have been motivated to make any combination from among these 407,330 references. Yet Dr. Hansen fails to show why a POSITA would be motivated to make the particular combination among the seven 802.11 references that he cherry-picked from among the hundreds of thousands of 802.11 references. This approach of combining references simply

[redacted]

because they refer to 802.11 would not produce the specific references that Dr. Hansen selected. Instead, it appears that Dr. Hansen improperly used hindsight to select these particular references by focusing on the limitations presented in the claims of the ’738 patent, and not by independently determining if there would have been a motivation to combine particular references and teachings with those of Merlin 258, for example.

1374. Then Dr. Hansen argues that each reference is “reasonably pertinent to the problem faced by the inventor” so they “would have logically commended themselves to the inventors’ attention in considering the problem they were attempting to address.” Hansen Report at ¶2383. But Dr. Hansen never identifies what he believes the problem was that faced the ‘738 inventor. *Id.* Without an understanding or identification of the problem being addressed in the ’738 patent, one must ask what the criteria was for Dr. Hansen’s selection of the materials that were selected. The lack of any answer in this regard suggests that the reason for the combination was an after-the-fact reconstruction of the ’738 patent, using the ’738 invention as the blueprint.

1375. The ’622 provisional application, which was incorporated by reference into the ’738 patent (at 1:7-11), provides the Background for the ’738 invention. The ’622 provisional states that “A data transmitting and receiving procedure and frame designing method for the procedure are suggested in order to use such multi-user MIMO scheme in the WLAN.” ’622 provisional application at Page 1, Summary; *see also* ’738 patent at 1:40-57. According to the ’622 provisional, “[i]t is expected that a new WLAN following the IEEE 802.11ac will adopt a uplink multi-user MIMO (UL MU-MIMO) scheme” but “various new frames and an advance preparation procedure are required.” ’622 provisional at Background. The background of the ’622 provisional concludes with the statement “Accordingly, the present application is purposed to define a new frame for supporting UL MU-MIMO without violating operations of the previous WLAN and to define a frame transmitting and receiving procedure.” *Id.* Thus, one driving design for the ’738 invention

[redacted]

was to develop a new transmitting and receiving procedure with a new frame content and format that would support uplink multi-user transmissions.

1376. In addition to developing a new frame to support UL MU transmissions for upcoming versions of 802.11, it also was critical to the ’738 patent to develop a solution that was backwards compatible to prior versions of 802.11. Backwards compatibility is an important consideration when developing or modifying requirements in a standard. Consequently, any modifications to 802.11, for example, must consider the impact that any modifications would have on the ability of legacy devices to continue to operate. This is especially critical with regard to the teachings of the Yuan reference, which is directed to cellular technologies.

1377. The teachings of Yuan pose significant questions regarding backwards compatibility, especially as those concepts are attempted to be migrated to other standards, such as 802.11. Yuan itself notes the issues with backwards compatibility relative to 3GPP, as it suggests including a legacy downlink control channel (PDCCH) region in addition to the extensions it proposes. Figure 1 shows an enhanced PDCCH transmission added to the legacy PDCCH region. This enhanced control channel region thus is tacked onto a legacy control channel transmission. There is no suggestion or concept provided by Dr. Hansen of how Yuan’s mixed time division multiplexing + frequency division multiplexing for an extension control channel would be applied to 802.11.

1378. Dr. Hansen does not specifically identify the problems the various references he cites are attempting to address. Further, I note that several of the references upon which Dr. Hansen relies were already considered in combination by the patent examiner during the prosecution of the ’738 patent. Further, the examiner specifically sought to combine the teachings of merlin 258, Zhang and Yuan and ultimately concluded those combined teachings did not render obvious the inventions claimed in the ’738 patent.

1379. In his Motivation to Combine section, Dr. Hansen block quotes passages from each reference in isolation and argues that each “discloses teaching, suggestions, and

[redacted]

motivations **to use the disclosed system**." Hansen Report at ¶¶2384-2391 (emphasis added). But it is immaterial whether each of Dr. Hansen's references individually teach, suggest, and motivate a POSITA to use the system disclosed by that individual reference. What matters in an obviousness determination involving multiple references is whether a POSITA would have been motivated **to combine teachings from multiple references**. Dr. Hansen's analysis is thus irrelevant to whether it would have been obvious to combine together the teachings of multiple different references.

1380. For Merlin 258, Dr. Hansen quotes the Abstract but does not address what the Abstract says. Hansen Report at ¶2384. Next he block quotes [0005] but again says nothing about the relevance of that block quote. Third he block quotes Merlin 258 [0055], but again offers no insight into these passages. Generally, the Abstract and [0005] of Merlin 258 are addressed to the desirability of UL MU transmissions. Additionally, the Abstract describes an AP sending multiple messages with an indication of at least operational parameter for the transmission of uplink data. The third passage ([0055] of Merlin 258 describes the necessity of providing an HEW capability indication from terminals with regard to UL MU transmissions.

1381. For Yuan, Dr. Hansen block quotes the Yuan Abstract, again without any explanation. He also block quotes Yuan paragraph [0002]. Hansen Report at ¶2385. In contrast to Merlin 258, the Yuan passages describes a 4G cellular standard where resource scheduling is performed in centralized fashion at a base station and scheduling grants for downlink and uplink transmissions occur. Yuan [0002]. Yuan's invention involves an enhanced physical downlink control channel multiplexed with physical downlink data channel in frequency division multiplexing (FDM), or in frequency division multiplexing (FDM)+time division multiplexing (TDM). Yuan, Abstract. Yuan also describes UL grants of different users being cross-interleaved and transmitted over the entire physical resource blocks in both slots. Abstract.

[redacted]

1382. The subsequent paragraphs of Dr. Hansen's Report (¶¶2386-2391) proceed in similar fashion relative to the other six references selected by Dr. Hansen. As was the case with Merlin 258 and Yuan, Dr. Hansen provides no explanation of the significance or relevance of the passages he quotes or why those passages would have motivated a PODITA to combine together teachings of these references.

1383. Dr. Hansen concludes (without any analysis or supporting evidence) that "at the time of the invention, it would have been obvious for a POSITA to combine the teachings of any combination of the above references, using known methods as disclosed in the references, to yield predictable results." Hansen Report at ¶2392. I disagree. Dr. Hansen has not provided any evidence or analysis of predictable results. Nor does he identify the teachings he proposes would have been combined.

1384. Dr. Hansen continues in his ¶2392 by referring to "simple substitution," "reasonable expectation of success," "finite number of identified, predictable solutions," and "design incentives or other market forces." Hansen Report at ¶2392. But he provides no analysis and he does not identify what are the simple substitutions; why there is a reasonable expectation of success; the finite number of identified, predictable solutions; and/or the design incentives or other market forces. To the extent that Dr. Hansen is suggesting that it would have been obvious to modify the content, format and protocol of the messages used to support UL MU transmissions, he has provided no basis, justification or explanation of how or why to make such modifications.

1385. Finally, Dr. Hansen identifies several "exemplary combinations" that he alleges render the '738 claims obvious. I disagree that these exemplary combinations would have rendered obvious the '738 claims for the reasons which follow. In addition, all of these combinations include references that have not been shown to be prior art to the '738 patent, which as noted above has a priority date of April 4, 2014. *See* Priority for '738 Patent. Specifically, Dr. Hansen has not shown that Merlin 258, Merlin 690, Vermani or Chu are prior art to the '738 Patent

[redacted]

11.5.9.2 Merlin 258 and Yuan and/or Merlin 690

1386. First, Dr. Hansen alleges that it would be obvious to modify Merlin '258 with either or both of Yuan or Merlin 690. ¶2393. I disagree that this combination of references would have rendered obvious the claims of the '738 patent.

1387. As an initial matter, Dr. Hansen seems to suggest that this combination of references only teaches Limitations 1[a] (which corresponds to my Limitation 1b generating downlink data) and 1[c] (which corresponds to my Limitation 1d: transmitting downlink data and uplink setup information in a single physical downlink frame). While I disagree that these references show these Limitations or that it would have been obvious to combine together these references, even if true, there are other Limitations, including for example Limitations 1g and 1j, which are not met by these references as I noted above. In addition, if the Yuan signaling messaging were used instead of the CTX messaging in Merlin 258, then Limitations 1c and 1g-1i would not be met by the proposed combination for the reasons I outlined in Section 11.5.2 related to Yuan.

1388. As I noted above, Merlin '258 describes transmitting a clear to transmit (CTX) message 402 to user terminals (UT) 120 indicating which UTs may participate in the UL MU-MIMO transmission. [0053]. This is shown in Figure 4 of Merlin's '258 published application:

[redacted]

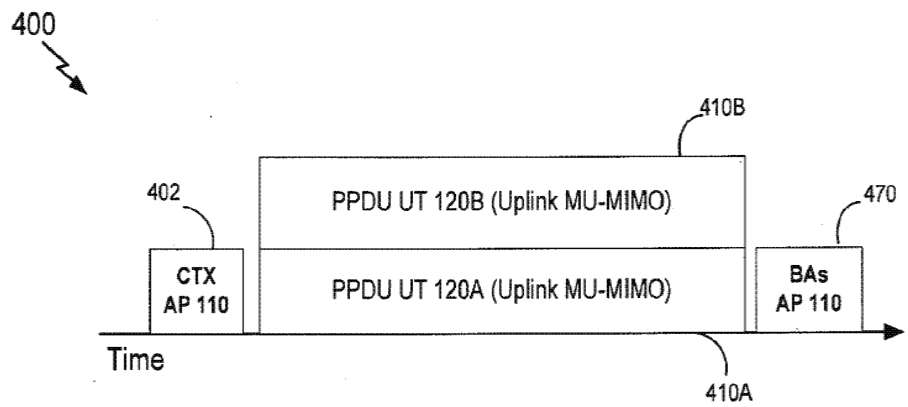


FIG. 4

1389. Dr. Hansen seems to be suggesting that it would have been obvious to modify the CTX message used in Merlin 258 to a different transmission, such as that suggested by Yuan to include downlink data and uplink setup information in the same frame. Hansen Report at ¶2394. But doing so would then eliminate the CTX messaging structure shown in Figure 9 that Dr. Hansen relied on to attempt to show multiple Limitations of the '738 claimed invention relative to Limitations 1c and 1g-1i, for example. *See* Hansen Report at ¶¶1969-1973; 2098-2104. Replacing the messaging structure of Merlin 258 with Yuan's messaging structure fails to meet these Limitations for the reason I identify in Section 11.5.2 above.

1390. In addition, Yuan is fundamentally different than Merlin 258, and it would not have been obvious to a POSITA to combine together the teachings of these two references. The Yuan published application is primarily concerned with resource multiplexing between the physical downlink control channel and the physical downlink data channel in 4G communications. Yuan at [0006]. As shown in Figure 1 of Yuan, each subframe contains 2 slots.

[redacted]

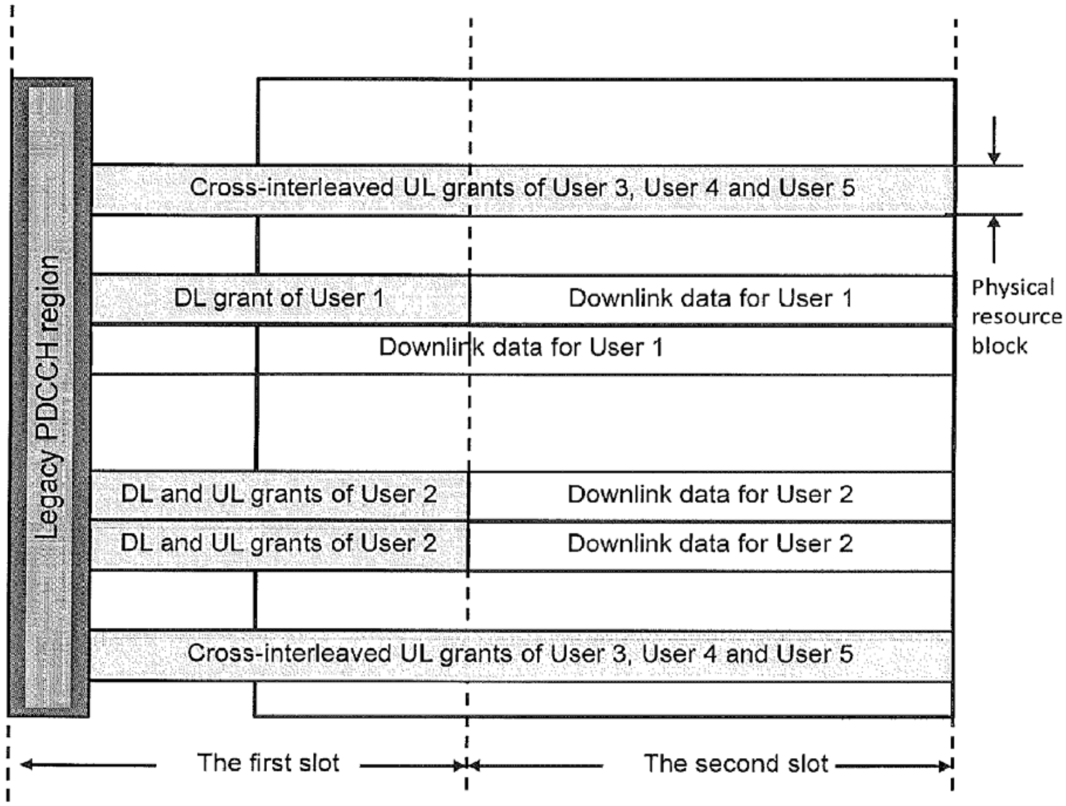


Figure 1

In this figure, User 1 has only a DL grant, with the 1st slot of the resource block providing the DL grant and the 2nd slot used for User 1's downlink data transmission. The adjacent resource block also is used for downlink data transmission. The DL and UL grant of User 2 is mixed in the 1st slot of 2 adjacent resource blocks. The DL data for User 2 is transmitted in the 2nd slot of 2 adjacent resource blocks. UL grants of Users 3, 5 and 5 are cross-interleaved, and mapped to the 1st and 2nd slots of two non-adjacent resource blocks, which are frequency distributed.

1391. As Figure 1 of Yuan illustrates, the transmission of user specific grant information may occur in different time slots at different times, and the same is true of the downlink data. For example, the UL grant of Users 3, 4 and 5 occur in multiple non-adjacent resource blocks and in both slots 1 and 2, whereas the grant for User 1 only occurs in a single

[redacted]

resource unit and in the 1st time slot. The grant to user 2 occurs in multiple adjacent resource units, but also only in the 1st slot. The downlink data for user 1 spans 2 resource elements, and relative to the second resource unit, spans both the 1st slot and the 2nd slot. There is no downlink data for Users 3, 4, and 5, which have their grants interleaved across the entire resource element.

1392. The uplink transmission that ultimately results from the uplink grant in Yuan is not identified. While Yuan discusses DL and UL grants, Yuan only shows the transmissions of downlink data. Yuan is completely silent on any UL MU transmission, and thus Yuan does not indicate that the UL grants will solicit a simultaneous UL MU response from a plurality of station devices. Further, the detail of what the content is of the DL and UL grant transmissions is not provided in Yuan.

1393. Thus, to the extent that Dr. Hansen is suggesting that the CTX frame in Merlin 258 be replaced with the multiplexed control and data transmissions from Yuan there is no basis provided by Dr. Hansen to do so, other than to attempt to meet the limitations of the ’738 claims. This signaling message of Yuan uses TDM + FDM together in a multiplexed physical downlink control channel and a physical downlink data channel as used in cellular communications. The result would be that rather than using the CTX message from Merlin 258, Yuan’s multiplexed signaling would be used, as generally depicted below:

[redacted]

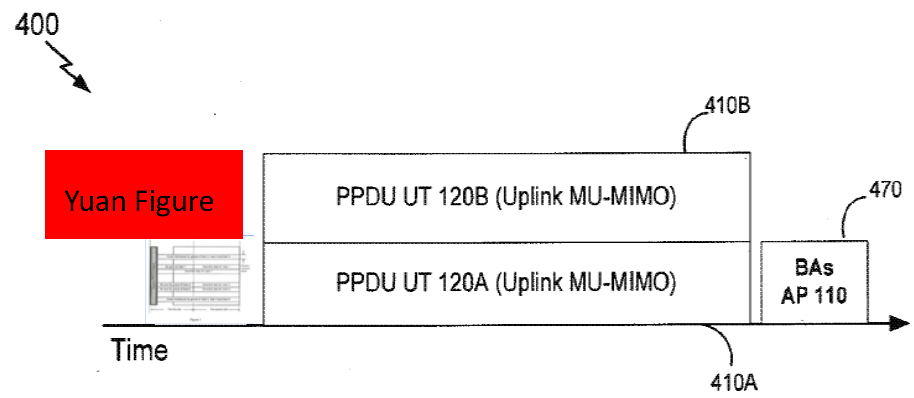


FIG. 4

1394. A person skilled in the art would not have deemed it obvious to use the Yuan signaling mechanism instead of the CTX message disclosed in Merlin 258. Yuan describes a concept that is specific to 3GPP cellular communications, which varies significantly from 802.11 WLAN communications. Specifically, Yuan proposes multiplexing between downlink control and downlink data channels using both time division multiplexing and frequency division multiplexing. Yuan at [0006]. The resource mapping proposed by Yuan covers using these two concepts together in downlink transmissions: (1) cross-interleaving control channel information (UL grants) of different users and mapping this control information to all the time slots of a resource block, while preventing downlink data from being transmitted in those resource blocks; and (2) including control channel information (DL grant and UL grant if present) of one user and mapping that information to only the 1st time slot or a resource block, while allowing downlink data to be transmitted in the 2nd time slot of that same resource block. The manner in which these concepts would have been used or implemented in the context of 802.11 is never explained in the Hansen report, and there is nothing in Yuan that even remotely suggests using these techniques for other protocols.

[redacted]

1395. In addition, backwards compatibility is an important consideration when developing or modifying requirements in a standard. Consequently, any modifications to 802.11, for example, must consider the impact that any modifications would have on the ability of legacy devices to continue to operate. The idea of permitting control information and/or data to be located in certain slots of resource units in some instances, but allowing control information and/or data to be located in all slots of resource units in other instances, as suggested by Yuan, poses significant questions regarding backwards compatibility, especially as those concepts are attempted to be migrated to other standards, such as 802.11.

1396. Further, the teaching of Yuan is to only include downlink data in the PDCCH transmission in the limited situation where a DL grant is provided to a specific User. Nothing in Yuan suggests including downlink data with an uplink grant to a plurality of stations. Thus, it appears that Dr. Hansen is suggesting that the concepts suggested in Yuan be further modified based on the '738 patent, and not on the teachings of the references themselves. I understand that using the teachings of the '738 patent to reconstruct or alter the teachings of any alleged prior art is an improper use of hindsight.

1397. In addition, Yuan is silent on 2 fundamental aspects of the '738 claims. First, the '738 claims are drawn to providing uplink setup information to initiate an UL MU transmission from multiple stations, with those UL MU transmissions using information provided in the UL setup information to construct those transmissions. Yuan does not disclose UL MU transmissions, so it follows that Yuan does not disclose providing uplink setup information to trigger UL MU transmissions. Dr. Hansen also ignores the impact that this would have on Merlin 258 if combined with Yuan. Dr. Hansen is mixing and matching specific and distinct teachings of Merlin and Yuan in a manner that neither contemplated.

1398. Second, the '738 claims provide very specific requirements regarding the structure and content of the uplink setup information. Yuan is silent on the content of its control channel information, and thus it discloses nothing relative to these aspects of the '738

[redacted]

claims. Merlin, conversely, discloses a very specific arrangement and protocol with regard to the CTX message that is used as part of the signaling for uplink transmissions. Figure 9 identifies the fields that are to be included in the CTX message of Merlin 258, and those fields are necessary to achieve the objectives and operation of the Merlin 258 system. Replacing the CTX signaling of Merlin 258 with the multiplexed control channel and data channel of Yuan would result in a system that varies both from the claimed invention and also from the Merlin configuration.

1399. In that same paragraph ¶2393, Dr. Hansen further suggests modifying the combination with Merlin 690. It is completely unclear how Merlin 258 would be modified based on Yuan and Merlin 690. The concepts of Yuan and Merlin 690 are sufficiently dissimilar that it is not possible to determine exactly what modifications Dr. Hansen was envisioning when he prosed this combination.

1400. To the extent that Dr. Hansen is proposing modifying Merlin 258 only with Merlin 690, it is unclear exactly what the resulting messaging structure would be if Merlin 258 and Merlin 690 were proposed based on the two sentences relied on by Dr, Hansen in his ¶2394 related to A-MPDUs. Further, Dr. Hansen does not clearly identify what he contends is uplink setup information and what he contends is downlink data relative to Merlin 690, as I explained above relative to Merlin 690 and Limitation 1d. Dr. Hansen once again copies passages from Merlin 690 [0176] without further explanation that clarifies how this claim limitation is met by Merlin 690. Lastly, [0187] of Merlin 690 again refers to the special frame in Merlin 690, but once again, Dr. Hansen doesn't clearly indicate if this special frame refers to downlink data or an uplink setup information. *See e.g.* Hansen Report at ¶2015.

1401. Even if Merlin 258 and 690 were combined, and if they were prior art (which has not been established), the resulting combination still does not teach or disclose other limitations, such as Limitation 1g, 1h and 1j, as noted above relative to the discussion of those references.

[redacted]

1402. Based on the foregoing, it would not have been obvious to combine together Merlin 258, Yuan and/or Merlin 690, and doing so would not have rendered obvious the '738 claims.

11.5.9.3 Merlin 258 and Chu and/or Kang

1403. The second exemplary combination identified by Dr. Hansen is to modify Merlin '258 with either or both of Chu or Kang. ¶2394. I disagree that this combination of references would have rendered obvious the claims of the '738 patent.

1404. As an initial matter, Dr. Hansen seems to suggest that this combination of references only teaches Limitations 1[a] (which corresponds to my Limitation 1b generating downlink data) and 1[c] (which corresponds to my Limitation 1d: transmitting downlink data and uplink setup information in a single physical downlink frame). While I disagree that these references show these Limitations or that it would have been obvious to combine together these references, even if true, there are other Limitations, including for example Limitations 1g and 1j, which are not met by these references as I noted above. In addition, if the Chu or Kang messaging were used instead of the CTX messaging in Merlin 258, then Limitations 1c and 1g-1i would not be met by the proposed combination for the reasons I outlined in Section 11.5.6 related to Chu and Section 11.5.7 relative to Kang.

1405. Merlin '258 describes transmitting a clear to transmit (CTX) message 402 to user terminals (UT) 120 indicating which UTs may participate in the UL MU-MIMO transmission. [0053]. This is shown in Figure 4 of Merlin's '258 published application:

[redacted]

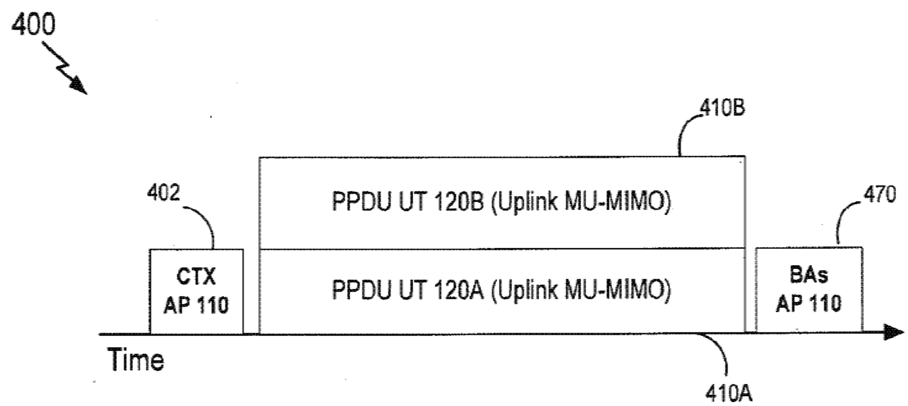


FIG. 4

1406. Dr. Hansen seems to suggest that it would have been obvious to modify the CTX message used in Merlin 258 to a different transmission, such as that suggested by Chu or Kang. Hansen Report at ¶2395. But doing so would then eliminate the CTX messaging structure shown in Figure 9 that Dr. Hansen relied on to attempt to show multiple Limitations of the ’738 claimed invention relative to Limitations 1c and 1g-1i, for example. *See* Hansen Report at ¶¶1969-1973; 2098-2104. Replacing the messaging structure of Merlin 258 with Chu or Kang fails to meet these Limitations for the reason I identify in Sections 11.5.6 and 11.5.7 above.

1407. Dr. Hansen in ¶2395 block quotes Chu at 13:47-14:13, which references Figure 6. This passage refers to a communication frame that correspond to a CTS-to-Self frame 610:

[redacted]

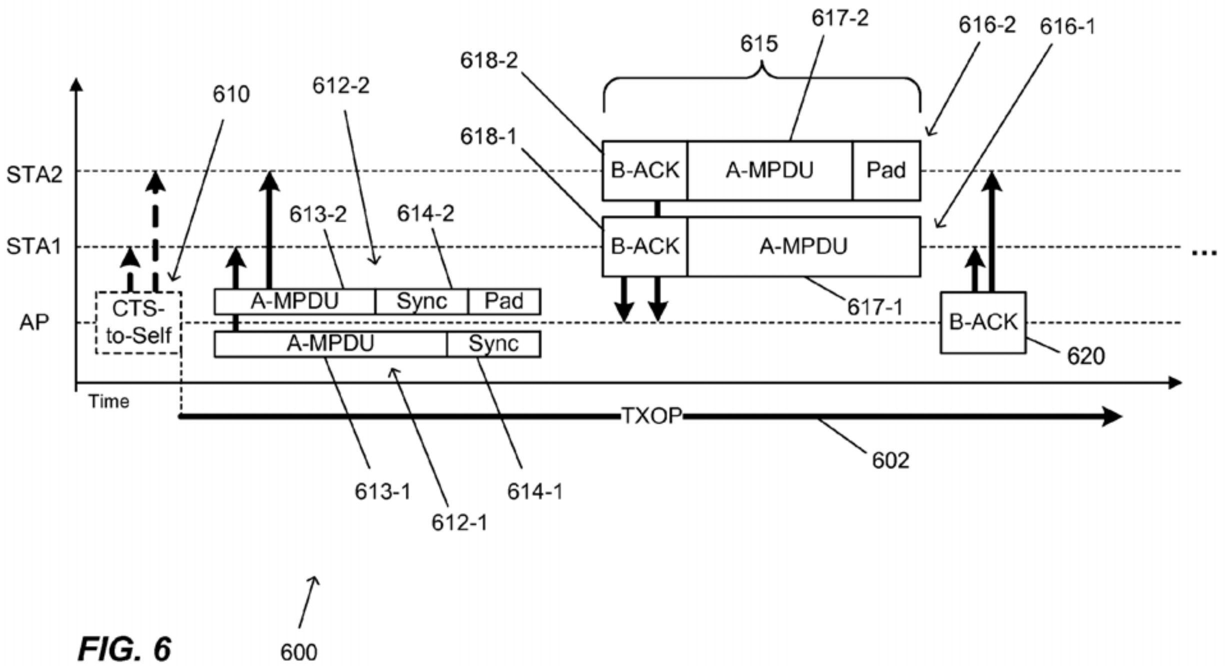


FIG. 6

1408. After the CTS-to-Self communication frame, the AP transmits DL data units 612 that include respective aggregate media access control protocol data units (A-MPDU) 613 and a communication signal 614. As was the case previously, Dr. Hansen does not explain which of these transmissions correlate to downlink data and which correspond to uplink setup information.

1409. Next, Dr. Hansen refers to Kang at 13:23-41, again without any explanation of how he maps that passage to the language of Limitation 1d. Hansen, ¶2395. This passage appears to indicate that transmission channel bandwidth information to be signaled to STAs may be included in a VHT-SIGB field (shown in Figure 4). Once again, Dr. Hansen does not explain how this passage correlates with the requirements of Limitation 1d. Specifically, he does not indicate what he contends correlates to either uplink setup information or downlink data relative to this passage in column 13.

1410. In addition, Dr. Hansen does not explain why one skilled in the art would replace the CTX messaging in Merlin 258 with the messaging used in Chu or Kang. As I noted in the previous section, and incorporated herein by reference, Merlin 258 specifically elected to implement a CTX messaging technique with a specific format and content to support

[redacted]

uplink transmissions. There is no apparent reason why a skilled artisan would deviate from that approach, nor does Dr. Hansen provide any reason to do so. Merlin 258 provided specific details regarding the structure of the CTX frame, which is something that is lacking in Chu and Kang.

1411. For these reasons, I disagree that the proposed combination of Merlin 258 and either or both Chu or Kang would have rendered obvious the ’738 claims.

11.5.9.4 Merlin 258 and Zhang and/or Vermani

1412. The third exemplary combination identified by Dr. Hansen is to modify Merlin ‘258 with either or both of Zhang or Vermani. ¶2396. I disagree that this combination of references would have rendered obvious the claims of the ’738 patent.

1413. As an initial matter, Dr. Hansen seems to suggest that this combination of references only teaches Limitation 1[g] (which corresponds to my Limitation 1j]. While I disagree that these references show this Limitation or that it would have been obvious to combine together these references, even if true, there are other Limitations, including for example Limitations 1d and 1g, which are not met by these references as I noted above. In addition, if the Zhang or Vermani messaging were used instead of the CTX messaging in Merlin 258, then Limitation 1g-1i would not be met by the proposed combination for the reasons I outlined in Section 11.5.3 related to Zhang and Section 11.5.5 relative to Vermani.

1414. Merlin ’258 describes transmitting a clear to transmit (CTX) message 402 to user terminals (UT) 120 indicating which UTs may participate in the UL MU-MIMO transmission. [0053]. This is shown in Figure 4 of Merlin’s ’258 published application:

[redacted]

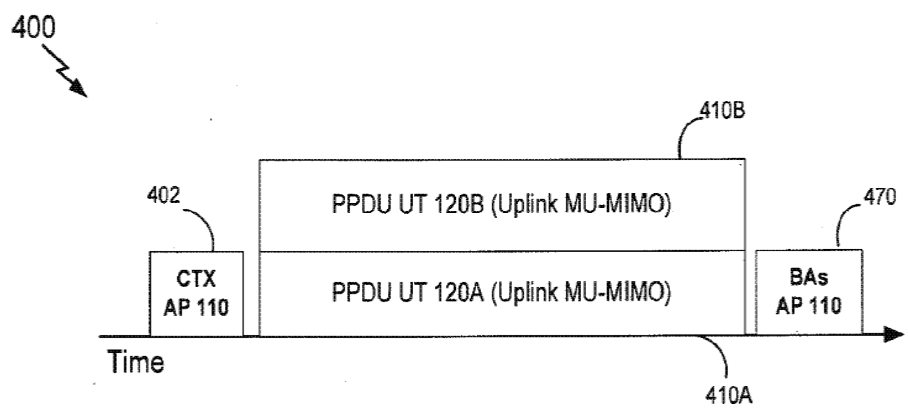


FIG. 4

1415. Dr. Hansen seems to be suggesting that it would have been obvious to modify the CTX message used in Merlin 258 to a different transmission, such as that suggested by Zhang or Vermani to identify in a common information portion information that is functionally related to the total number of space times streams used in the uplink transmission from the plurality of stations. Hansen Report at ¶2396. But doing so would then eliminate the CTX messaging structure shown in Figure 9 that Dr. Hansen relied on to attempt to show multiple Limitations of the ’738 claimed invention relative to Limitations 1c and 1g-1i, for example. *See* Hansen Report at ¶¶1969-1973; 2098-2104. Replacing the messaging structure of Merlin 258 with Zhang or Vermani fails to meet these Limitations for the reason I identify in Sections 11.5.3 and 11.5.5 above.

1416. Dr. Hansen cites to Zhang at 10:29-47 as meeting Limitation 1j. Hansen Report at ¶2396. I disagree that Zhang discloses this Limitation 1j, and the passage from Zhang quoted by Dr. Hansen do not support his conclusion that this limitation is met, as I noted above in Section 11.5.3. The cited portion of Zhang identifies the parameters that may be provided by the AP in a synchronization frame 202. This includes the total number of space-time streams available for uplink transmission**.** Zhang at 10:37-38. Note that Zhang

[redacted]

appears to be referencing the total number of streams ***available***, not the total number of space time streams "**to be used to transmit the multiple uplink frames**," as per Claim 1**.** The number of available streams only refers to the number of streams that a device may theoretically support, based on the number of antennas, for example. But this theoretical availability is not the same thing as the total number of streams actually to be used for a particular multi-user uplink transmission.

1417. This exact issue was discussed and addressed during the prosecution of the '738 patent. '738 PH at 330, 344, 350-351. Specifically, after amending the claims to add this Limitation 1j to overcome the combined teachings of Merlin 258, Yuan and Zhang, the patent owner Newracom stated relative to Zhang:

> Zhang discloses transmitting information on a "total number of space-time streams available for uplink transmission," Zhang, col. 10, ll. 37-38, but does not disclose transmitting the information on a total number of spatial streams actually used to perform multiple uplink frames, as recited in the present claims. The number of stream used may be different (in particular, may be less) than the number of streams available.

'738 PH at 330. The examiner subsequently agreed that Zhang did not, in fact, include the concept of including in an uplink setup transmission information that related functionally to the total number of streams actually to be used and he allowed the '738 claims. '738 PH at 349-351.

1418. As the patent examiner concluded, neither Zhang, Merlin nor Yuan disclose Limitation 1j. The passage from Zhang on which Dr. Hansen relies states that the synchronization frame may identify the total number of streams available, but that does not correlate to the claimed requirement of identifying information related functionally to the total number of space time streams to be used:

[redacted]

> duration Tu), according to an embodiment. Further, depending on the particular embodiment, the synchronization frame **202** includes one or more of the following: an indication of which of the SUT-capable stations are expected to transmit uplink data during the SUT period **200**, a respective index assigned to each SUT-capable station expected to communicate during the SUT period **200**, the total number of space-time streams available for uplink transmission, a listing of space-time streams allocated to each individual SUT-capable station for the SUT period **200**, bandwidth of SUT frames (e.g., 20 MHz, 40 MHz, 80 MHz), a respective modulation and coding scheme for each SUT-capable station expected to transmit during the SUT period **200**, a respective power control parameter for each SUT-capable station expected to transmit during the SUT period **200**, the maximum duration of an SUT frame that can be transmitted during the SUT period **200**, etc.

Zhang at 10:31-47. In addition to failing to define information relating to the total number of streams actually to be used, it is not clear from Zhang that this information necessarily would be provided in a common information field of the synchronization frame when most if not all of the other listed parameters in that sentence appear to refer to dedicated information. Certainly Zhang does not clearly demarcate that the total stream information is commonly applied and used by each of the stations. In fact, Zhang makes no attempt to apportion the information provided into a common field and a dedicated field, but instead identifies a number of possible parameters without any sort of organization or grouping. In addition, this passage also references identifying the particular streams allocated to particular users, which clearly is not common information, as was also the case with Merlin 258 as discussed above.

1419. The Zhang patent refers to the number of space-time streams on several occasions. None of those passages state that the space-time stream information provided in Zhang is (i) part of a common information field; and (ii) represents the total number of space time streams "to be used to transit the multiple uplink frames" as required in Limitation 1j. For example, the Summary in Zhang indicates that the synchronization frame specifies a space-

[redacted]

time mapping parameter and data is received from the plurality of devices in accordance with the space-time mapping parameter. The space-time mapping parameter is information that is user specific, and it is used by the station to identify on which space time stream it should transmit its data. This discussion is consistent with the description in 7:49-57 (describing using matrix to map values). The space-time mapping parameter does not identify a total number of space time streams.

1420. Ultimately, Dr. Hansen's reliance on the Zhang patent suffers from the same deficiencies that existed relative to Merlin 258.

1421. The Vermani reference also does not disclose Limitation 1j. Dr. Hansen cites paragraphs [0114], [0116] and [0117] as supposedly meeting Limitation 1j. Hansen Report at ¶¶2397. These passages from Vermani do not indicate that the access point transmits uplink setup information with a common information portion that includes information that is a function of the total number of space time streams to be transmitted by the users. At most, Vermani identifies the number of HE-LTF fields, and that this number may be the same as the number of HE-LTF as that for DL MU MIMO transmission. [0116] – [0117].

1422. In [0112], Vermani states that his disclosure provides preamble formats and other PHY aspects that may be used in HEW WiFi, including for UL MU-MIMO. The next paragraph [0113] then notes that for UL MU-MIMO, a prior setup by an AP may occur, which includes certain information such as a stream allocation, a frequency correction reference, a precise time to transmit and power control information. Vermani does not indicate or suggest that this information is common information. In fact, he does not appear to organize the information provided in any particular manner. If anything, this information appears to be station specific information, although Vermani is silent on that point.

1423. Vermani in [0114] then indicates that the UL MU-MIMO may involve similar specifications as DL MU-MIMO. This includes allowing up to 8 spatial streams total with 4 streams maximum per STA, with a maximum of 4 users.

[redacted]

1424. Paragraph [0116] describes the different fields of the preamble, as shown in Figure 3A.

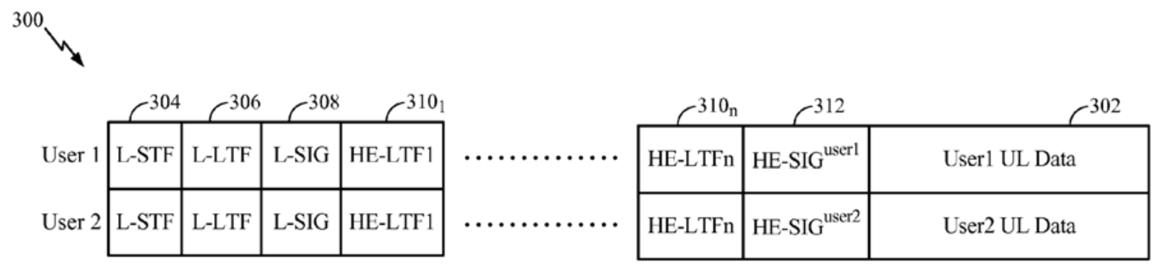


FIG. 3A

1425. Relative to the HE-LTF field, Vermani states that the number (n) of HE-LTF fields "is determined by the total number of uplink streams, which may be the same as that for downlink (DL) MU-MIMO." Vermani at [0116]. Thus, Vermani instructs that the decision regarding the total number of uplink streams is determined based on the number of streams used in the downlink transmission. Vermani in [0116] does not indicate that the AP sends a message regarding the total number of HE-LTF symbols or the total number of spatial streams to be used in the uplink transmission. Instead, Vermani teaches that the number of streams is derived based on the downlink transmission streams, with the number of uplink streams matching the number of downlink streams.

1426. In the subsequent paragraph [0117], Vermani states:

[redacted]

> **[0117]** Prior to the uplink transmit opportunity (TXOP), the AP **110** may inform the client which streams to use and the maximum TXOP duration. The client can still decide the modulation and coding scheme (MCS) and the packet length (<max TXOP duration). The number of streams is an upper constraint. A lower number of streams in data may be transmitted by the client, but the number of LTFs should stay the same as the total number of streams decided by the AP **110** and provided in the AP's message transmitted to the client. For certain aspects, the client may transmit zeros on the unused stream(s). The maximum TXOP duration may be used as a spoof length by uplink clients in the L-SIG field. Each client may transmit an identical L-SIG field **308**, but with different cyclic shifts. Cyclic shift delays (CSDs) here may most likely be much larger than legacy CSDs for accurate gain setting, which might cause issues for legacy devices which use cross-correlation.

According to this passage, Vermani indicates that the AP may inform the client which streams to use and the TXOP direction, while the client may independently determine other parameters such as the MCS to use. Further, the client may determine to use less streams than indicated by the AP, but the number of LTFs should stay the same as decided by the AP.

1427. Nothing in Vermani references setup information with a common information portion and a dedicated information portion. Nor does Dr. Hansen indicate that Vermani discloses this information regarding the manner in which the uplink setup information is organized. Vermani does not indicate that the number of HE-LTF fields or the number of spatial streams be identified in a common information portion of uplink setup information. Vermani is silent regarding the organizational structure of the uplink setup information, or the timing of when and how that information is provided. Further, Vermani seems to suggest that some information is determined independently by the clients, and some is derived based on the parameters used in a prior DL transmission (versus providing that information in discrete fields of an uplink setup transmission or frame).

1428. Dr. Hansen contends in ¶2397 that a POSITA would be motivated to modify Merlin 258 to meet the limitations of Claim 1 Limitation 1j. Vermani does not support this

[redacted]

conclusion, and Vermani simply does not identify any organization or configuration of the information to be provided to the station devices, as I note above.

1429. In summary there is nothing in Vermani that discloses a common information portion of an uplink setup transmission with information that relates functionally to the total number of space time streams to be used in an UL MU transmission.

1430. In addition, Dr. Hansen does not explain why one skilled in the art would replace the CTX messaging in Merlin 258 with the messaging used in Zhang or Vermani. As I noted above, Merlin 258 specifically elected to implement a CTX messaging technique with a specific format and content to support uplink transmissions as shown in Figure 9. There is no apparent reason why a skilled artisan would deviate from that approach, nor does Dr. Hansen provide any reason to do so. Merlin 258 provided specific details regarding the structure of the CTX frame, which is something that is lacking in Vermani and Zhang.

1431. For the reasons stated above, it would not have been obvious to combine together the teachings of Merlin 258 and either or both of Zhang or Vermani, and doing so would not have rendered obvious the ’738 claims.

11.5.9.5 Merlin 258 and Chu and/or Gong

1432. The fourth exemplary combination identified by Dr. Hansen is to modify Merlin ‘258 with either or both of Chu or Gong. ¶2398. I disagree that this combination of references would have rendered obvious the claims of the ’738 patent.

1433. As an initial matter, Dr. Hansen seems to suggest that this combination of references only teaches Limitations 1[g] (which corresponds to my Limitation 1j]. While I disagree that these references show this Limitation or that it would have been obvious to combine together these references, even if true, there are other Limitations, including for example Limitations 1d and 1g, which are not met by these references as I noted above. In addition, if the Chu or Gong messaging were used instead of the CTX messaging in Merlin

[redacted]

258, then Limitation 1g-1i would not be met by the proposed combination for the reasons I outlined in Section 11.5.6 related to Chu and Section 11.5.8 relative to Gong.

1434. Dr. Hansen seems to suggest that it would have been obvious to modify the CTX message used in Merlin 258 to a different transmission, such as that suggested by Chu or Gong to identify in a common information portion information that is functionally related to the total number of space times streams used in the uplink transmission from the plurality of stations. Hansen Report at ¶2398. But doing so would then eliminate the CTX messaging structure shown in Figure 9 that Dr. Hansen relied on to attempt to show multiple Limitations of the '738 claimed invention relative to Limitations 1c and 1g-1i, for example. *See* Hansen Report at ¶¶1969-1973; 2098-2104. Replacing the messaging structure of Merlin 258 with Chu or Gong fails to meet these Limitations for the reason I identify in Sections 11.5.6 and 11.5.8 above.

1435. Dr. Hansen simply refers back to his prior analysis of Chu and Gong. Hansen Report at ¶2398. As a result, I incorporate by reference my discussion of those references.

1436. In addition, Dr. Hansen does not explain why one skilled in the art would replace the CTX messaging in Merlin 258 with the messaging used in Chu or Gong. As I noted above, Merlin 258 specifically elected to implement a CTX messaging technique with a specific format and content to support uplink transmissions as shown in Figure 9. There is no apparent reason why a skilled artisan would deviate from that approach, nor does Dr. Hansen provide any reason to do so. Merlin 258 provided specific details regarding the structure of the CTX frame, which is something that is lacking in Chu and Gong.

11.5.9.6 Merlin 258 and Yuan and/or Merlin 690 and/or Zhang and/or Vermani

1437. The fifth exemplary combination identified by Dr. Hansen is to modify Merlin '258 with any combination of Yuan and/or Merlin 690 and/or Zhang and/or Vermani. ¶2399. Although I am unclear how Dr. Hansen is proposing to combine these different references, I generally disagree that this combination of references would have rendered obvious the

[redacted]

claims of the ’738 patent. For this opinion, I incorporate by reference my discussion above in Sections 11.5.9.2 and 11.5.9.4.

1438. Until such time as Dr. Hansen clarifies the limitations he contends these different references are mapped to, I am unable to respond in detail to his opinion with regard to these five references.

1439. Dr. Hansen seems to be suggesting that it would have been obvious to modify the CTX message used in Merlin 258 to a different transmission, such as that suggested by one or more of the four other references he cites in this exemplary combination. But doing so would then eliminate the CTX messaging structure shown in Figure 9 that Dr. Hansen relied on to attempt to show multiple Limitations of the ’738 claimed invention relative to Limitations 1c and 1g-1i, for example. *See* Hansen Report at ¶¶1969-1973; 2098-2104. Replacing the messaging structure of Merlin 258 with Yuan, Merlin 690, Zhang, and/or Vermani fails to meet these Limitations for the reason I identify in Sections 11.5.2, 11.5.4, 11.5.3 and 11.5.5 above.

1440. In addition, Dr. Hansen does not explain why one skilled in the art would replace the CTX messaging in Merlin 258 with the messaging used in these other references. As I noted above, Merlin 258 specifically elected to implement a CTX messaging technique with a specific format and content to support uplink transmissions as shown in Figure 9. There is no apparent reason why a skilled artisan would deviate from that approach without some compelling reason, which neither the references or Dr. Hansen provide.

11.5.9.7 Chu and Kang and/or Gong

1441. The sixth exemplary combination identified by Dr. Hansen is to modify Chu with either or both of Kang or Gong. ¶2400. I disagree that this combination of references would have rendered obvious the claims of the ’738 patent.

1442. As an initial matter, Dr. Hansen seems to suggest that this combination of references only teaches Limitations 1[a] (which corresponds to my Limitation 1b

[redacted]

generating downlink data) and 1[c] (which corresponds to my Limitation 1d: transmitting downlink data and uplink setup information in a single physical downlink frame). While I disagree that these references show these Limitations or that it would have been obvious to combine together these references, even if true, there are other Limitations, including for example Limitations 1g and 1j, which are not met by these references as I noted above. In addition, if the Kang or Gong messaging were used instead of the messaging used in Chu, then other Limitations would not be met by the proposed combination for the reasons I outlined in Section 11.5.7 related to Kang and Section 11.5.8 relative to Gong.

1443. Chu at 13:47-14:13, which is a passage that Dr. Hansen cites elsewhere in his report, references Figure 6. This passage refers to a communication frame that correspond to a CTS-to-Self frame 610:

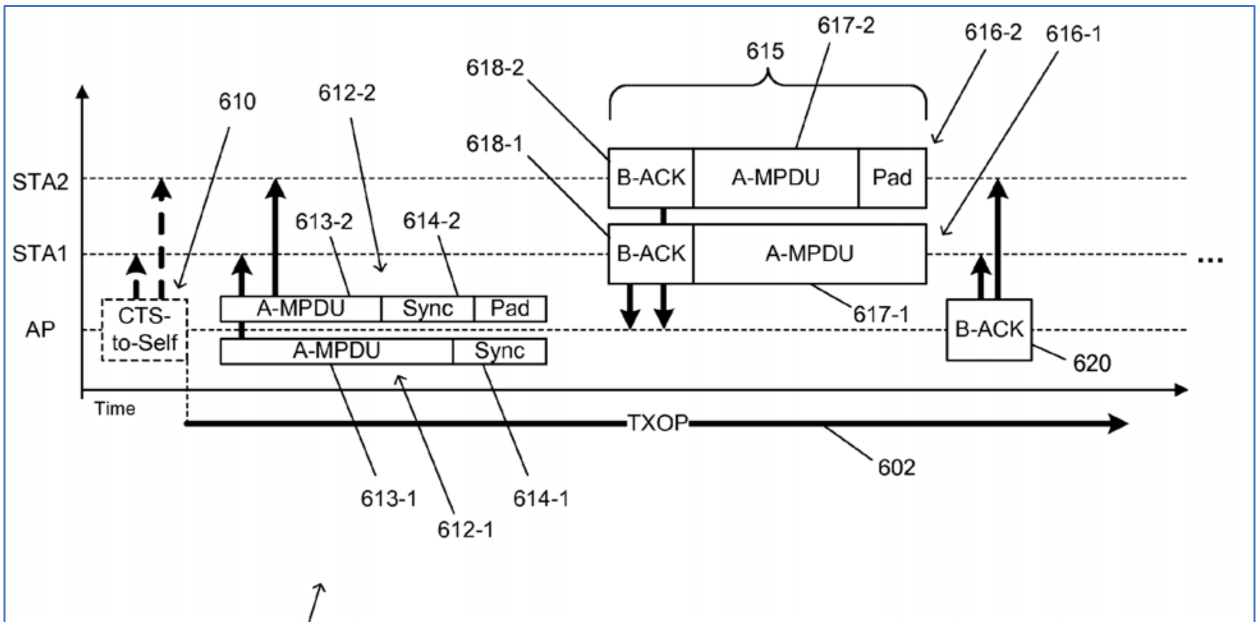


FIG. 6

1444. After the CTS-to-Self communication frame, the AP transmits DL data units 612 that include respective aggregate media access control protocol data units (A-MPDU) 613 and a communication signal 614. Dr. Hansen never explains which of these transmissions correlate to downlink data and which correspond to uplink setup information.

[redacted]

1445. Dr. Hansen does not clearly explain how he proposes to modify Chu. As such, I simply refer to my prior distinctions with regard to Kang and Gong and incorporate those distinctions here. Further, it is unclear how or why a POSITA would modify Chu based on the teachings of Kang or Gong, which appear to refer to prior version so the 802.11 standard.

1446. Dr. Hansen refers to Kang, again without any explanation of how he maps that passage to the language of Limitation 1d. Hansen, ¶2400. The passage in Kang at 13:23-41, for example, appears to indicate that transmission channel bandwidth information to be signaled to STAs may be included in a VHT-SIGB field (shown in Figure 4). Once again, Dr. Hansen does not explain how this passage correlates with the requirements of Limitation 1d. Specifically, he does not indicate what he contends correlates to either uplink setup information or downlink data relative to this passage in column 13.

1447. Gong [0014], referenced in ¶2038, refers to a group action frame. This frame contains the multicast address, the total number of streams, the max duration of the A-MPDUs in the UL MU MIMO transmission, AIDs of STAs in the group, MCS, and optionally a stream bitmap field. Dr. Hansen does not identify what information within the group action frame constitutes downlink data. But as I noted above in my discussion of Gong, he identifies all of these parameters as satisfying requirements of uplink setup information in other claim limitations. Dr. Hansen has not clearly shown that any of the identified parameters in Gong [0014] or [0017] or [0018] which correlate to downlink data.

1448. For these reasons, I disagree that the proposed combination of Chu and either Kang or Gong would have rendered obvious the '738 claims.

11.5.9.8 Merlin 258 and/or Chu with Yuan and/or Zhang and/or Merlin 690 and/or Vermani and/or Kang and/or Gong

1449. The last exemplary combination identified by Dr. Hansen is to combine Merlin '258 and/or Chu with any combination of Yuan and/or Zhang and/or Merlin 690 and/or Vermani and/or Kang and/or Gong. ¶2401. Although I am unclear how Dr. Hansen is

[redacted]

proposing to combine these many different references, I generally disagree that this combination of references would have rendered obvious the claims of the '738 patent. For this opinion, I incorporate by reference my discussion above in Sections 11.5 in its entirety relative to each of these references and combinations.

1450. Until such time as Dr. Hansen clarifies the limitations he contends these different references are mapped to, I am unable to respond in detail to his opinion with regard to these five references.

1451. Dr. Hansen seems to be suggesting that it would have been obvious to modify the CTX message used in Merlin 258 to a different transmission, such as that suggested by one or more of the four other references he cites in this exemplary combination. But doing so would then eliminate the CTX messaging structure shown in Figure 9 that Dr. Hansen relied on to attempt to show multiple Limitations of the '738 claimed invention relative to Limitations 1c and 1g-1i, for example. *See* Hansen Report at ¶¶1969-1973; 2098-2104. Replacing the messaging structure of Merlin 258 with any of the other references fails to meet these Limitations for the reason I identify in the various Sections 11.5 above relative to each of these references and combinations.

1452. In addition, Dr. Hansen does not explain why one skilled in the art would replace the CTX messaging in Merlin 258 with the messaging used in these other references. As I noted above, Merlin 258 specifically elected to implement a CTX messaging technique with a specific format and content to support uplink transmissions as shown in Figure 9. There is no apparent reason why a skilled artisan would deviate from that approach without some compelling reason, which neither the references or Dr. Hansen provide.

12. THE ART REFERENCED IN THE HANSEN REPORT DOES NOT INVALIDATE THE ASSERTED CLAIMS OF THE '513 PATENT

12.1 Overview of the '513 Patent

1453. The '513 Patent is titled "System and Method for Synchronization for OFDMA Transmission." '513 Patent (ATLAS-00014189-213, Hansen Ex. 513-1) at Title Page. It

[redacted]

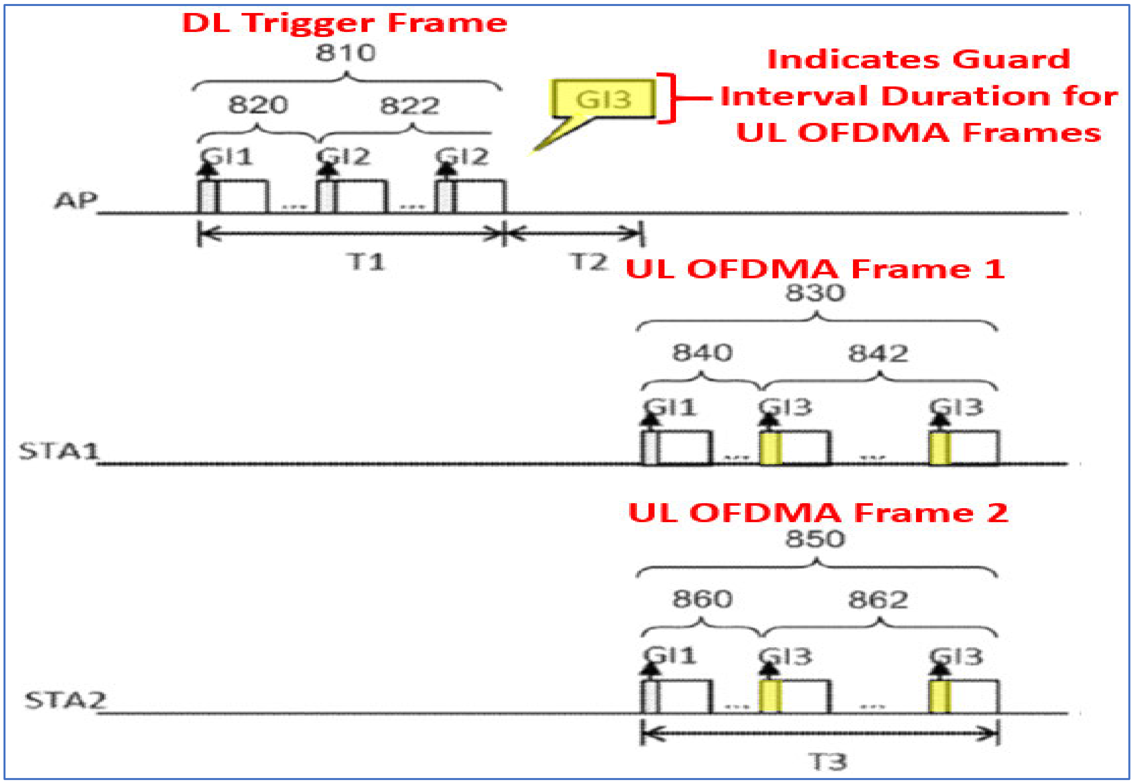
was invented by Younghoon Kwon while working on the next-generation Wi-Fi 6 802.11ax standard at Newracom. *Id.* The '513 Patent claims priority to October 14, 2014. *Id.* It issued on March 6, 2018. *Id.*

1454. The '513 Patent generally relates to 802.11ax OFDMA transmissions, and more specifically to 802.11ax downlink trigger frames sent by access points that indicate the guard interval (GI) duration of the expected uplink responsive frames sent by the stations. '513 at 1:21-25, 2:47-52, 2:61-65.

1455. In multi-user OFDMA, stations may simultaneously transmit uplink frames where each field within an uplink frame includes: (1) a guard interval (sometimes referred to as a "cyclic prefix") and then (2) one or more symbols. '513 at 10:49-65. If the guard interval durations are not uniform amongst all the stations, the symbols will not be synchronized and the access point "may have greater difficulty correctly decoding the frames received from the STAs." *Id.* at 3:28-33. To ensure that all the stations use the same guard interval duration, the access point may transmit a "trigger frame [with] information for a guard interval (GI) duration … to be used for at least some symbols of a [subsequent] UL frame." *Id.* at 2:61-65, 3:34-39, 3:62-67.

1456. Annotated Figure 8 shows such a trigger frame 810 that "include[s] information on a guard interval duration GI3 (*e.g.*, information or a value that can identify GI3) to be utilized by the participating stations." '513 at 17:17-20. The guard interval duration GI3 "may be provided in a payload in the second part 822 of the downlink [trigger] frame 810." *Id.* at 17:20-22. "The AP sets the guard interval duration GI3 to better accommodate the different propagation delays associated with the different stations." *Id.* at 17:43-45. "The participating stations use the guard interval duration GI3 indicated by the downlink [trigger] frame 810 for UL OFDMA transmission of the second part of their respective uplink frames 830 and 850 (e.g., the remaining parts 842 and 862)." *Id.* at 17:34-37.

[redacted]



Id. at Fig. 8 (red annotations and yellow highlighting added).

1457. The '513 Patent has three independent claims, claims 1, 9 and 15. Apparatus claim 1 and method claim 9 are drafted from the perspective of the 802.11 station, while method claim 15 is drafted from the perspective of the 802.11 access point. I have reproduced these three independent claims below, using the same annotations as Dr. Hansen:

1[pre]. An apparatus for facilitating wireless communication, the apparatus comprising: one or more memories; and one or more processors coupled to the one or more memories, the one or more processors configured to cause:

1[a] receiving, in a trigger frame transmitted by an access point, an indication of a first guard interval length, wherein the trigger frame allocates one or more resources for an uplink (UL) multi-user (MU) transmission and solicits the UL MU transmission, wherein a value of the first guard interval length is to be used by each of a plurality of stations, including the apparatus, associated with the UL MU transmission,

1[b] generating an uplink frame for the UL MU transmission solicited by the trigger frame, wherein the uplink frame comprises a payload and a physical layer (PHY) header, and

[redacted]

1[c] transmitting the uplink frame using a resource allocated by the trigger frame to the apparatus,

1[d] wherein at least a portion of the payload of the uplink frame is associated with the first guard interval length.

9[pre]. A method for facilitating wireless communications between a wireless device and an access point, the method comprising:

9[a] receiving, by the wireless device in a downlink frame from the access point, an indication of a first cyclic prefix (CP) length, wherein the downlink frame is for allocating resources for an uplink (UL) multi-user (MU) transmission and for soliciting the UL MU transmission, wherein the first CP length is the same length to be used for all of a plurality of stations addressed by the downlink frame in the UL MU transmission;

9[b] generating, by the wireless device, an uplink frame for the UL MU transmission solicited by the downlink frame, wherein the uplink frame comprises a payload; and

9[c] transmitting the uplink frame using a resource allocated by the downlink frame,

9[d] wherein at least a portion of the payload of the uplink frame is associated with the first CP length.

15[pre]. A computer-implemented method of facilitating wireless communication, the method comprising:

15[a] determining, by an access point, a first guard interval to be used by a set of stations participating in a multi-user (MU) uplink (UL) transmission; creating, by the access point, a trigger frame, wherein the trigger frame includes information indicating the first guard interval for the UL MU transmission, wherein the trigger frame allocates resources for the UL MU transmission and solicits the UL MU transmission;

15[b] transmitting, by the access point, the trigger frame to the set of stations; and

15[c] processing an uplink frame comprising a plurality of frames from the set of stations based on the resources for the UL MU transmission, wherein each of the plurality of frames comprises a respective payload, and wherein at least a portion of the respective payload is associated with the first guard interval.

[redacted]

1458. Dr. Hansen provides a summary of the asserted claims of the '513 Patent, which I generally agree with. Hansen Report at ¶137. However, I disagree with his conclusion that "the claimed inventions [of the '513 claims] were previously known in the art." *Id.*

12.2 '513 Prosecution History

1459. The '513 Patent is a continuation of U.S. Patent No. 9,413,581. Thus, the prosecution histories of both that '581 (parent) Patent and the '513 Patent are relevant.

12.2.1 The '581 Parent Prosecution

1460. On September 28, 2015, the Applicant filed the '581 application with 20 initial claims. ATLAS-00014423-6. The Applicant requested expedited prosecution under Track 1. ATLAS-00014383.

1461. On January 12, 2016, the Applicant disclosed an international search report from a related PCT application. ATLAS-00014484-5. Per the search report, most of the claims were anticipated by U.S. published patent application 2013/0022090 to Weng. ATLAS-00014450-58. On February 1, 2016, the Examiner rejected the majority of the claims as either anticipated or obvious in view of Weng. ATLAS-00014492-500. But the Examiner found that dependent claims 6-9, 13, 17 and 20 contained allowable subject matter. ATLAS-00014500-1.

1462. On March 8, 2016, the Applicant and the Examiner had an interview during which the Applicant proposed some claim amendments. ATLAS-00014527-35. On March 11, 2016, the Applicant formally amended the independent claims to include the limitations of dependent claims 8-9:

[redacted]

> 1. (Currently Amended) An apparatus for facilitating wireless communication, the apparatus comprising:
>
> one or more memories; and
>
> one or more processors coupled to the one or more memories, the one or more processors configured to cause:
>
> determining a second cyclic prefix length based on a first frame received;
>
> generating a second frame that comprises a first set of symbols and a second set of symbols, the first set of symbols being associated with a first cyclic prefix length, the second set of symbols being associated with the second cyclic prefix length; and
>
> providing the second frame for transmission,
>
> wherein the first set of symbols comprises a legacy header portion and a first non-legacy header portion, and the second set of symbols comprises a second non-legacy header portion and a payload portion, and
>
> wherein the payload portion of the second frame is associated with the second cyclic prefix length and wherein the second non-legacy header portion of the second frame is associated with the second cyclic prefix length.

ATLAS-00014517 (highlighting added).

1463. On April 6, 2016, the Examiner allowed the claims and remarked that none of the prior art of record taught or suggested all of the claim limitations, especially the two newly-amended limitations. ATLAS-00014538-44. On July 6, 2016, the Applicant commented on the Examiner's reasons for allowance and explicitly disagreed that patentability rested solely on the newly-added limitations. ATLAS-00014561-2. The '581 Patent issued on August 9, 2016.

12.2.2 The '513 Prosecution

1464. The Applicant filed the '513 application on June 6, 2016 with 19 initial claims. ATLAS-00014225-69. The Examiner rejected those claims on July 28, 2017 for double patenting in view of the '581 Patent. ATLAS-00014285-91. The Applicant submitted a terminal disclaimer on October 30, 2018 to expedite prosecution. ATLAS-00014302-8. The Examiner allowed the claims on November 22, 2017, noting that Weng (the closest prior art of record) failed to teach all claimed features, especially these features:

[redacted]

> However regarding **claims 1 and 15** none of the prior art of the record explicitly teaches or fairly suggests all of the claimed limitation, especially the features of: wherein the trigger frame allocates one or more resources for an uplink (UL) multi-user (MU) transmission and solicits the UL MU transmission, wherein a value of the first guard interval length is to be used by each of a plurality of stations, including the apparatus, associated with the UL MU transmission, generating an uplink frame for the UL MU transmission solicited by the trigger frame, wherein the uplink frame comprises a payload and a physical layer (PHY) header, and transmitting the uplink frame using a resource allocated by the trigger frame to the apparatus, wherein at least a portion of the payload of the uplink frame is associated with the first guard interval length.

ATLAS-00014321-4 (highlighting added).

1465. On January 25, 2018, the Applicant disagreed with the Examiner's reasoning in the notice of allowance. ATLAS-00014335-6. The '513 Patent issued on March 6, 2018.

1466. Dr. Hansen provides a summary of the '513 prosecution history, which I mostly agree with. Hansen Report at ¶138. However, I disagree with his conclusion that the above highlighted claim limitations from the Examiner's Nov. 22, 2017 notice of allowance were the only '513 claim limitations that were novel and/or non-obvious. *Id.*

12.3 '513 Priority Date

1467. The '513 Patent claims priority to provisional application no. 62/061,503, filed on October 8, 2014:

> **Related U.S. Application Data**
>
> (60) Provisional application No. 62/061,503, filed on Oct. 8, 2014.

ATLAS-00014191.

1468. That provisional application is titled "System and method for synchronization of OFDMA transmission." ATLAS-00014369. And the Abstract of that provisional states:

> A method is provided for synchronizing OFDM symbol boundary when multiple users transmit frames simultaneously in OFDMA way. The method comprises

[redacted]

receiving at a first station a first frame, wherein the first frame comprises information on resource allocation that the first station is scheduled to transmit, sending at the first station a second frame, wherein the guard interval of each OFDM symbol of payload part of the second frame is the same as that of payload part of the first frame.

Id.

1469. While that provisional application discloses several embodiments, the Figure 4 embodiment is most relevant:

A method is provided for synchronizing OFDM symbol boundary when multiple users transmit frames simultaneously in OFDMA way. The method comprises receiving at a first station a first frame, wherein the first frame comprises information on resource allocation that the first station is scheduled to transmit, sending at the first station a second frame, wherein the guard interval of each OFDM symbol of payload part of the second frame is the same as that of payload part of the first frame.

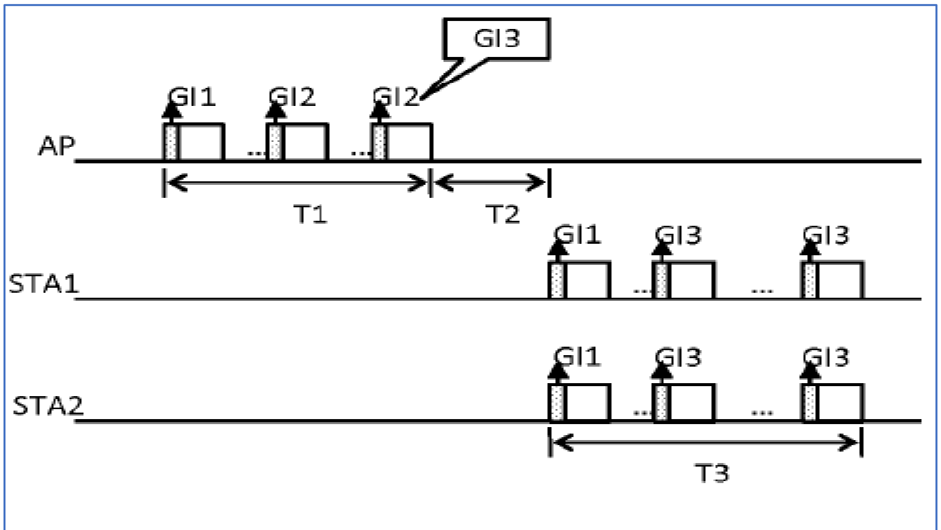


Figure 4: Indication of GI in the trigger frame

The first frame indicates the scheduling information on OFDMA transmission. The guard interval of the first part of the first frame is set at a predetermined value (GI1). And, depending on situation, the AP chooses to use another guard interval (GI2) for the rest of the first frame (a second part of the first frame). The situation may include multi-path delay profile of the received signal, different propagation delay to and from multiple different stations, accuracy of timing alignment capabilities of participating stations, and so on. The first frame further comprises an information on the guard interval that the participating stations shall use (GI3) excluding the first part of the second frames, wherein the duration of the first part is predetermined, and wherein the first part of the second frames shall use a

[redacted]

predetermined guard interval (GI1) that is the same with that of the first part of the first frame.

When the participating station receives the first frame and identifies that the participating station is supposed to transmit its own frame T2 time after receiving the first frame and also identifies the guard interval value that the participating station shall use (GI3), the participating station uses guard interval of GI1 for the first part of its own second frame, which interval is predetermined, and uses the indicated guard interval (GI3) from the first frame for the rest of its own second frame when the participating station transmits the second frame in OFDMA manner.

As the duration of the first part of the second frame from each participating station is predetermined, all the second frames transmitted by the participating stations have exactly the same symbol duration.

ATLAS-00014374.

1470. As can be seen, there are many parallels between the Figure 4 embodiment of the provisional application and the Figure 8 embodiment of the '513 Patent. The provisional application teaches that the disclosed invention allows "the participating stations [to] synchronize the symbol duration and the received frames sent from multiple participating stations can avoid inter-symbol interferences which is caused by propagation delay difference among participating stations." ATLAS-00014375. This provides several benefits, including: (1) "maintain[ing] the same OFDM symbol duration for MU simultaneous transmission;" (2) "decreas[ing] the receiver complexity by aligning the OFDM symbol duration and maintaining the symbol synchronization;" and (3) "increase[ing] the overall network efficiency by allowing multiple station's simultaneous transmission in OFDMA manner." *Id.*

1471. In the paragraphs below, I explain on a limitation-by-limitation basis why the '513 provisional application fully supports the claims of the '513 Patent.

12.3.1 The '513 Provisional Fully Supports '513 Claim 1[PRE], 9[PRE], 15[PRE]

1472. The preamble of '513 claim 1 covers a typical 802.11 STA: "An apparatus for facilitating wireless communication, the apparatus comprising: one or more memories; and one or more processors coupled to the one or more memories, the one or more processors

[redacted]

configured to cause." The preambles of claims 9 and 15 are related in that they also cover a typical 802.11 STA and AP, respectively.

1473. The '513 provisional fully discloses typical 802.11 STAs and APs, for example:

> During the standardization activities of IEEE 802.11 Task Group ax, OFDMA (Orthogonal Frequency Division Multiple Access) technology is introduced for multiple access scheme to improve network efficiency. OFDMA is a technology that allows multiple stations to transmit frames simultaneously using non-overlapping frequency-time resource.
>
> In OFDMA transmission, if frames transmitted by different stations are not synchronized at the receiver side, it is hard for the receiver to correctly decode the frames. To maintain synchronization among participating stations for multi-user (MU) simultaneous transmission in OFDMA, use of a trigger frame is proposed. Data transmission procedure using the trigger frame is as below:
>
> - AP sends a trigger frame, which includes resource allocation information for all participating stations.
> - All participating stations sends its frames in the assigned resource at predetermined time after receiving the trigger frame.

ATLAS-00014370 (emphasis added).

12.3.2 The '513 Provisional Fully Supports '513 Claim 1[A], 9[A], 15[A]-[B]

1474. Limitation A of '513 claim 1 recites: "receiving, in a trigger frame transmitted by an access point, an indication of a first guard interval length, wherein the trigger frame allocates one or more resources for an uplink (UL) multi-user (MU) transmission and solicits the UL MU transmission, wherein a value of the first guard interval length is to be used by each of a plurality of stations, including the apparatus, associated with the UL MU transmission." Claims 9[A] and 15[A]-[B] are related.

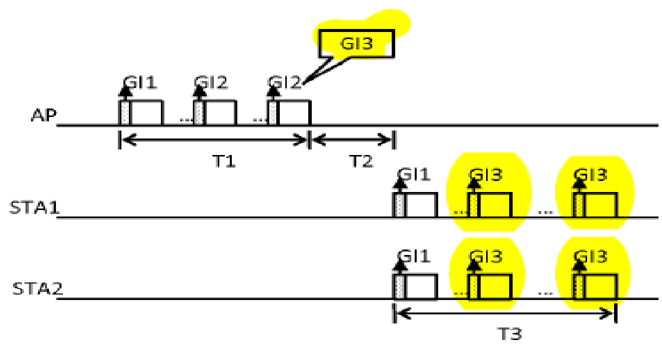
1475. The '513 provisional fully discloses trigger frames that allocate resources for and solicit UL MU transmissions, for example:

> In OFDMA transmission, if frames transmitted by different stations are not synchronized at the receiver side, it is hard for the receiver to correctly decode the frames. To maintain synchronization among participating stations for multi-user (MU) simultaneous transmission in OFDMA, use of a trigger frame is proposed. Data transmission procedure using the trigger frame is as below:
>
> - AP sends a trigger frame, which includes resource allocation information for all participating stations.
> - All participating stations sends its frames in the assigned resource at predetermined time after receiving the trigger frame.

[redacted]

ATLAS-00014370 (emphasis added).

1476. The '513 provisional also fully discloses that the trigger frame indicates a first guard interval length to be used by each of the stations in the UL MU transmission, for example:

> Figure 4 describes another embodiment of aligning GI duration of all participating stations of OFDMA transmission. In this embodiment, an AP sends a first frame to participating stations of OFDMA transmission (STA1 and STA2) during T1 period. Then, after predetermined time (T2) from the end of the transmission the first frame, each participating station sends its own second frame to the AP during T3 period in OFDMA manner.
>
> 
>
>
> Figure 4: Indication of GI in the trigger frame
>
> The first frame indicates the scheduling information on OFDMA transmission. The guard interval of the first part of the first frame is set at a predetermined value (GI1). And, depending on situation, the AP chooses to use another guard interval (GI2) for the rest of the first frame (a second part of the first frame). The situation may include multi-path delay profile of the received signal, different propagation delay to and from multiple different stations, accuracy of timing alignment capabilities of participating stations, and so on. The first frame further comprises an information on the guard interval that the participating stations shall use (GI3) excluding the first part of the second frames, wherein the duration of the first part is predetermined, and wherein the first part of the second frames shall use a predetermined guard interval (GI1) that is the same with that of the first part of the first frame.
>
> When the participating station receives the first frame and identifies that the participating station is supposed to transmit its own frame T2 time after receiving the first frame and also identifies the guard interval value that the participating station shall use (GI3), the participating station uses guard interval of GI1 for the first part of its own second frame, which interval is predetermined, and uses the indicated guard interval (GI3) from the first frame for the rest of its own second frame when the participating station transmits the second frame in OFDMA manner.

ATLAS-00014374 (emphasis added).

12.3.3 The '513 Provisional Fully Supports '513 Claim 1[B], 9[B]

1477. Limitation B of '513 claim 1 recites: "generating an uplink frame for the UL MU transmission solicited by the trigger frame, wherein the uplink frame comprises a payload and a physical layer (PHY) header." Claim 9[B] is related.

[redacted]

1478. The '513 provisional fully discloses that the UL MU transmission uplink frame comprises a payload and a header, for example:

> A method is provided for synchronizing OFDM symbol boundary when multiple users transmit frames simultaneously in OFDMA way. The method comprises receiving at a first station a first frame, wherein the first frame comprises information on resource allocation that the first station is scheduled to transmit, sending at the first station a second frame, wherein the guard interval of each OFDM symbol of payload part of the second frame is the same as that of payload part of the first frame.

ATLAS-00014369 (emphasis added). Also, this passage from the '513 provisional shows the payload (green) and the header (red) of the uplink frame:

> Figure 4 describes another embodiment of aligning GI duration of all participating stations of OFDMA transmission. In this embodiment, an AP sends a first frame to participating stations of OFDMA transmission (STA1 and STA2) during T1 period. Then, after predetermined time (T2) from the end of the transmission the first frame, each participating station sends its own second frame to the AP during T3 period in OFDMA manner.

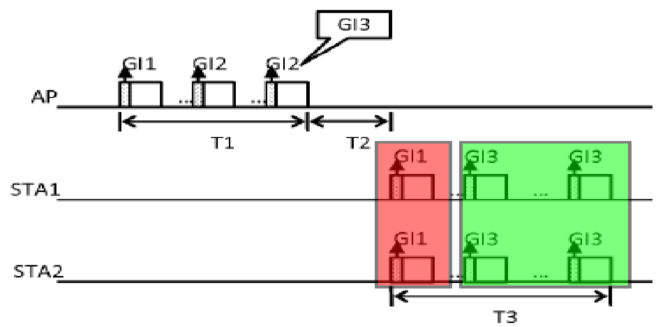


Figure 4: Indication of GI in the trigger frame

> The first frame indicates the scheduling information on OFDMA transmission. The guard interval of the first part of the first frame is set at a predetermined value (GI1). And, depending on situation, the AP chooses to use another guard interval (GI2) for the rest of the first frame (a second part of the first frame). The situation may include multi-path delay profile of the received signal, different propagation delay to and from multiple different stations, accuracy of timing alignment capabilities of participating stations, and so on. The first frame further comprises an information on the guard interval that the participating stations shall use (GI3) excluding the first part of the second frames, wherein the duration of the first part is predetermined, and wherein the first part of the second frames shall use a predetermined guard interval (GI1) that is the same with that of the first part of the first frame.
>
> When the participating station receives the first frame and identifies that the participating station is supposed to transmit its own frame T2 time after receiving the first frame and also identifies the guard interval value that the participating station shall use (GI3), the participating station uses guard interval of GI1 for the first part of its own second frame, which interval is predetermined, and uses the indicated guard interval (GI3) from the first frame for the rest of its own second frame when the participating station transmits the second frame in OFDMA manner.

ATLAS-00014374 (emphasis added).

[redacted]

12.3.4 The '513 Provisional Fully Supports '513 Claim 1[C], 9[C], 15[C]

1479. Limitation C of '513 claim 1 recites: "transmitting the uplink frame using a resource allocated by the trigger frame to the apparatus." Claims 9[C] and 15[C] are related.

1480. The '513 provisional fully discloses transmitting the uplink frame using the resource allocated by the trigger frame, for example:

> In OFDMA transmission, if frames transmitted by different stations are not synchronized at the receiver side, it is hard for the receiver to correctly decode the frames. To maintain synchronization among participating stations for multi-user (MU) simultaneous transmission in OFDMA, use of a trigger frame is proposed. Data transmission procedure using the trigger frame is as below:
>
> - AP sends a trigger frame, which includes resource allocation information for all participating stations.
> - All participating stations sends its frames in the assigned resource at predetermined time after receiving the trigger frame.

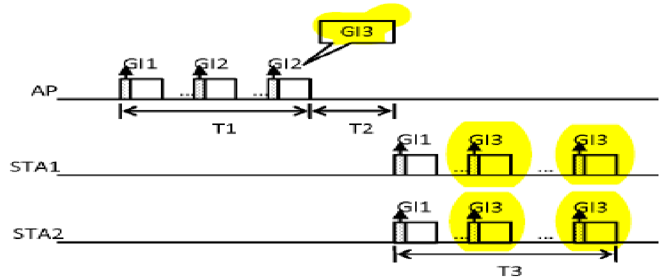
ATLAS-00014370 (emphasis added).

12.3.5 The '513 Provisional Fully Supports '513 Claim 1[D], 9[D], 15[C]

1481. Limitation D of '513 claim 1 recites: "wherein at least a portion of the payload of the uplink frame is associated with the first guard interval length." Claims 9[D] and 15[C] are related.

1482. The '513 provisional fully discloses that at least a portion of the payload of the uplink frame is associated with the first guard interval, for example:

[redacted]

> Figure 4 describes another embodiment of aligning GI duration of all participating stations of OFDMA transmission. In this embodiment, an AP sends a first frame to participating stations of OFDMA transmission (STA1 and STA2) during T1 period. Then, after predetermined time (T2) from the end of the transmission the first frame, each participating station sends its own second frame to the AP during T3 period in OFDMA manner.
>
> 
>
>
> Figure 4: Indication of GI in the trigger frame
>
> The first frame indicates the scheduling information on OFDMA transmission. The guard interval of the first part of the first frame is set at a predetermined value (GI1). And, depending on situation, the AP chooses to use another guard interval (GI2) for the rest of the first frame (a second part of the first frame). The situation may include multi-path delay profile of the received signal, different propagation delay to and from multiple different stations, accuracy of timing alignment capabilities of participating stations, and so on. The first frame further comprises an information on the guard interval that the participating stations shall use (GI3) excluding the first part of the second frames, wherein the duration of the first part is predetermined, and wherein the first part of the second frames shall use a predetermined guard interval (GI1) that is the same with that of the first part of the first frame.
>
> When the participating station receives the first frame and identifies that the participating station is supposed to transmit its own frame T2 time after receiving the first frame and also identifies the guard interval value that the participating station shall use (GI3), the participating station uses guard interval of GI1 for the first part of its own second frame, which interval is predetermined, and uses the indicated guard interval (GI3) from the first frame for the rest of its own second frame when the participating station transmits the second frame in OFDMA manner.

ATLAS-00014374 (emphasis added).

12.3.6 The '513 Provisional Fully Supports '513 Claims 2, 18

1483. '513 claim 2 recites: "the apparatus of claim 1, wherein the trigger frame comprises an implicit indication of when the uplink frame is to be transmitted as part of the UL MU transmission." Claim 18 is related.

1484. The '513 provisional fully discloses that the trigger frame implicitly indicates when the UL frame is to be transmitted, for example:

[redacted]

Figure 4 describes another embodiment of aligning GI duration of all participating stations of OFDMA transmission. In this embodiment, an AP sends a first frame to participating stations of OFDMA transmission (STA1 and STA2) during T1 period. Then, after predetermined time (T2) from the end of the transmission the first frame, each participating station sends its own second frame to the AP during T3 period in OFDMA manner.

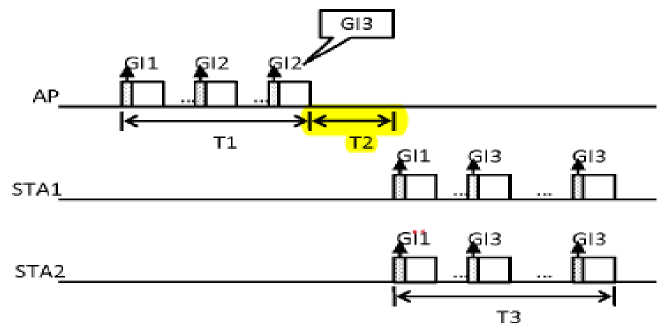


Figure 4: Indication of GI in the trigger frame

The first frame indicates the scheduling information on OFDMA transmission. The guard interval of the first part of the first frame is set at a predetermined value (GI1). And, depending on situation, the AP chooses to use another guard interval (GI2) for the rest of the first frame (a second part of the first frame). The situation may include multi-path delay profile of the received signal, different propagation delay to and from multiple different stations, accuracy of timing alignment capabilities of participating stations, and so on. The first frame further comprises an information on the guard interval that the participating stations shall use (GI3) excluding the first part of the second frames, wherein the duration of the first part is predetermined, and wherein the first part of the second frames shall use a predetermined guard interval (GI1) that is the same with that of the first part of the first frame.

When the participating station receives the first frame and identifies that the participating station is supposed to transmit its own frame T2 time after receiving the first frame and also identifies the guard interval value that the participating station shall use (GI3), the participating station uses guard interval of GI1 for the first part of its own second frame, which interval is predetermined, and uses the indicated guard interval (GI3) from the first frame for the rest of its own second frame when the participating station transmits the second frame in OFDMA manner.

ATLAS-00014374 (emphasis added).

12.3.7 The '513 Provisional Fully Supports '513 Claim 3, 13

1485. Claim 3 of the '513 Patent recites: "the apparatus of claim 1, wherein the one or more processors are further configured to cause transmitting the uplink frame at a predetermined time after receipt of a PHY protocol data unit (PPDU) that carries the trigger frame." Claim 13 is related.

1486. The '513 provisional fully discloses that the uplink frame is transmitted a predetermined time after the trigger frame, for example:

[redacted]

Figure 4 describes another embodiment of aligning GI duration of all participating stations of OFDMA transmission. In this embodiment, an AP sends a first frame to participating stations of OFDMA transmission (STA1 and STA2) during T1 period. Then, after predetermined time (T2) from the end of the transmission the first frame, each participating station sends its own second frame to the AP during T3 period in OFDMA manner.

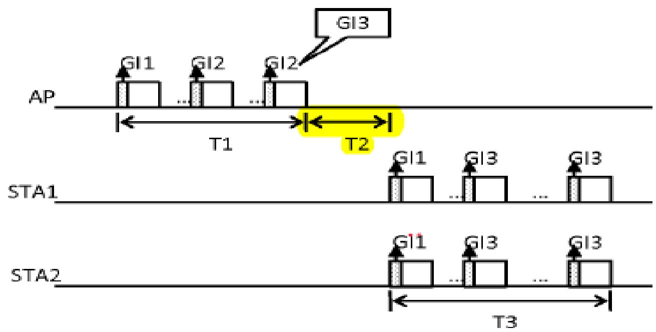


Figure 4: Indication of GI in the trigger frame

The first frame indicates the scheduling information on OFDMA transmission. The guard interval of the first part of the first frame is set at a predetermined value (GI1). And, depending on situation, the AP chooses to use another guard interval (GI2) for the rest of the first frame (a second part of the first frame). The situation may include multi-path delay profile of the received signal, different propagation delay to and from multiple different stations, accuracy of timing alignment capabilities of participating stations, and so on. The first frame further comprises an information on the guard interval that the participating stations shall use (GI3) excluding the first part of the second frames, wherein the duration of the first part is predetermined, and wherein the first part of the second frames shall use a predetermined guard interval (GI1) that is the same with that of the first part of the first frame.

When the participating station receives the first frame and identifies that the participating station is supposed to transmit its own frame T2 time after receiving the first frame and also identifies the guard interval value that the participating station shall use (GI3), the participating station uses guard interval of GI1 for the first part of its own second frame, which interval is predetermined, and uses the indicated guard interval (GI3) from the first frame for the rest of its own second frame when the participating station transmits the second frame in OFDMA manner.

ATLAS-00014374 (emphasis added).

12.3.8 The '513 Provisional Fully Supports '513 Claim 4, 12, 19

1487. Claim 4 of the '513 Patent recites: "the apparatus of claim 1, wherein the UL MU transmission comprises an uplink Orthogonal-Frequency Division Multiple Access (OFDMA) transmission, and wherein the first guard interval length is for the uplink OFDMA transmission." Claims 12 and 19 are related.

1488. The '513 provisional fully discloses guard intervals for uplink OFDMA transmissions, for example:

[redacted]

Figure 4 describes another embodiment of aligning GI duration of all participating stations of OFDMA transmission. In this embodiment, an AP sends a first frame to participating stations of OFDMA transmission (STA1 and STA2) during T1 period. Then, after predetermined time (T2) from the end of the transmission the first frame, each participating station sends its own second frame to the AP during T3 period in OFDMA manner.

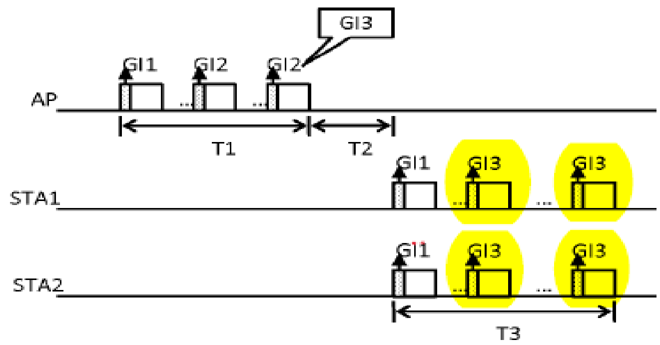


Figure 4: Indication of GI in the trigger frame

The first frame indicates the scheduling information on OFDMA transmission. The guard interval of the first part of the first frame is set at a predetermined value (GI1). And, depending on situation, the AP chooses to use another guard interval (GI2) for the rest of the first frame (a second part of the first frame). The situation may include multi-path delay profile of the received signal, different propagation delay to and from multiple different stations, accuracy of timing alignment capabilities of participating stations, and so on. The first frame further comprises an information on the guard interval that the participating stations shall use (GI3) excluding the first part of the second frames, wherein the duration of the first part is predetermined, and wherein the first part of the second frames shall use a predetermined guard interval (GI1) that is the same with that of the first part of the first frame.

When the participating station receives the first frame and identifies that the participating station is supposed to transmit its own frame T2 time after receiving the first frame and also identifies the guard interval value that the participating station shall use (GI3), the participating station uses guard interval of GI1 for the first part of its own second frame, which interval is predetermined, and uses the indicated guard interval (GI3) from the first frame for the rest of its own second frame when the participating station transmits the second frame in OFDMA manner.

ATLAS-00014374 (emphasis added).

12.3.9 The '513 Provisional Fully Supports '513 Claim 5, 10

1489. Claim 5 of the '513 Patent recites: "the apparatus of claim 1, wherein the PHY header is associated with a second guard interval length." Claim 10 is related.

1490. The '513 provisional fully discloses the PHY header of the UL frame is associated with a second guard interval length, for example:

[redacted]

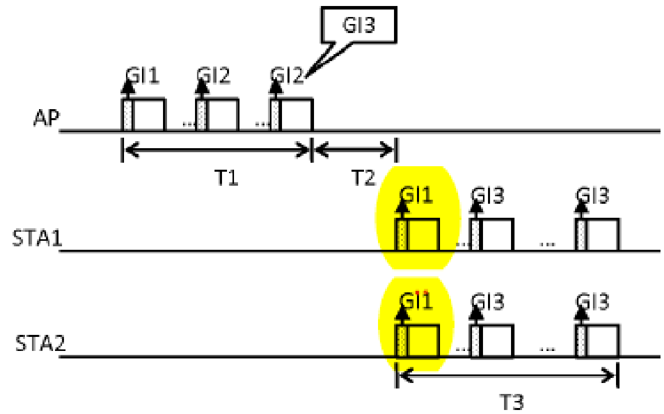


Figure 4: Indication of GI in the trigger frame

The first frame indicates the scheduling information on OFDMA transmission. The guard interval of the first part of the first frame is set at a predetermined value (GI1). And, depending on situation, the AP chooses to use another guard interval (GI2) for the rest of the first frame (a second part of the first frame). The situation may include multi-path delay profile of the received signal, different propagation delay to and from multiple different stations, accuracy of timing alignment capabilities of participating stations, and so on. The first frame further comprises an information on the guard interval that the participating stations shall use (GI3) excluding the first part of the second frames, wherein the duration of the first part is predetermined, and wherein the first part of the second frames shall use a predetermined guard interval (GI1) that is the same with that of the first part of the first frame.

When the participating station receives the first frame and identifies that the participating station is supposed to transmit its own frame T2 time after receiving the first frame and also identifies the guard interval value that the participating station shall use (GI3), the participating station uses guard interval of GI1 for the first part of its own second frame, which interval is predetermined, and uses the indicated guard interval (GI3) from the first frame for the rest of its own second frame when the participating station transmits the second frame in OFDMA manner.

ATLAS-00014374 (emphasis added).

12.3.10The '513 Provisional Fully Supports '513 Claim 6, 11

1491. Claim 6 of the '513 Patent recites: "the apparatus of claim 5, wherein the payload is comprised of a first set of orthogonal frequency-division multiplexing (OFDM) symbols and each OFDM symbol in the first set of OFDM symbols includes a guard interval of the first guard interval length." Claim 11 is related.

1492. The '513 provisional fully discloses that the payload of the UL frame uses OFDM symbols that are associated with the guard interval from the trigger frame, for example:

[redacted]

Figure 4 describes another embodiment of aligning GI duration of all participating stations of OFDMA transmission. In this embodiment, an AP sends a first frame to participating stations of OFDMA transmission (STA1 and STA2) during T1 period. Then, after predetermined time (T2) from the end of the transmission the first frame, each participating station sends its own second frame to the AP during T3 period in OFDMA manner.

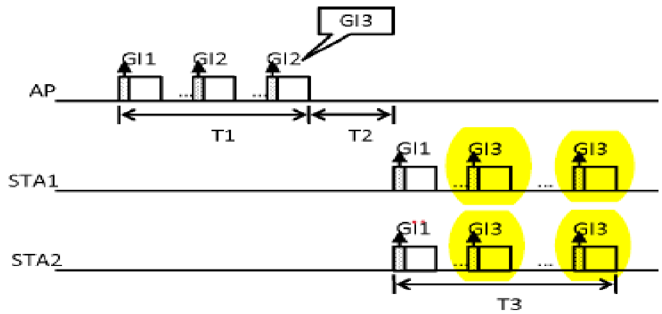


Figure 4: Indication of GI in the trigger frame

The first frame indicates the scheduling information on OFDMA transmission. The guard interval of the first part of the first frame is set at a predetermined value (GI1). And, depending on situation, the AP chooses to use another guard interval (GI2) for the rest of the first frame (a second part of the first frame). The situation may include multi-path delay profile of the received signal, different propagation delay to and from multiple different stations, accuracy of timing alignment capabilities of participating stations, and so on. The first frame further comprises an information on the guard interval that the participating stations shall use (GI3) excluding the first part of the second frames, wherein the duration of the first part is predetermined, and wherein the first part of the second frames shall use a predetermined guard interval (GI1) that is the same with that of the first part of the first frame.

When the participating station receives the first frame and identifies that the participating station is supposed to transmit its own frame T2 time after receiving the first frame and also identifies the guard interval value that the participating station shall use (GI3), the participating station uses guard interval of GI1 for the first part of its own second frame, which interval is predetermined, and uses the indicated guard interval (GI3) from the first frame for the rest of its own second frame when the participating station transmits the second frame in OFDMA manner.

ATLAS-00014374 (emphasis added). The '513 provisional similarly discloses:

A method is provided for synchronizing OFDM symbol boundary when multiple users transmit frames simultaneously in OFDMA way. The method comprises receiving at a first station a first frame, wherein the first frame comprises information on resource allocation that the first station is scheduled to transmit, sending at the first station a second frame, wherein the guard interval of each OFDM symbol of payload part of the second frame is the same as that of payload part of the first frame.

ATLAS-00014369 (emphasis added).

12.3.11The '513 Provisional Fully Supports '513 Claim 7, 11, 16-17

1493. Claim 7 of the '513 Patent recites: "the apparatus of claim 6, wherein the PHY header is composed of a second set of OFDM symbols and a third set of OFDM symbols and each OFDM symbol in the second set of OFDM symbols includes a guard interval of

[redacted]

the second guard interval length and each OFDM symbol in the third set of OFDM symbols includes a guard interval of the first guard interval length." Claims 11 and 16-17 are related.

1494. The '513 provisional fully discloses the PHY header has different sets of OFDM symbols, some of which use a .8µs "second guard interval length" and some of which use the "first guard interval length" indicated by the trigger frame, for example:

> Throughout this document, one of basic assumption is that the guard interval of a first part of any frame, which is composed of predetermined number of OFDM symbols, is set to a predetermined duration (GI1). For example, the guard interval of PLCP header part of an OFDM symbol is set to 0.8 usec regardless of using short guard interval at the payload side.

ATLAS-00014370 (emphasis added).

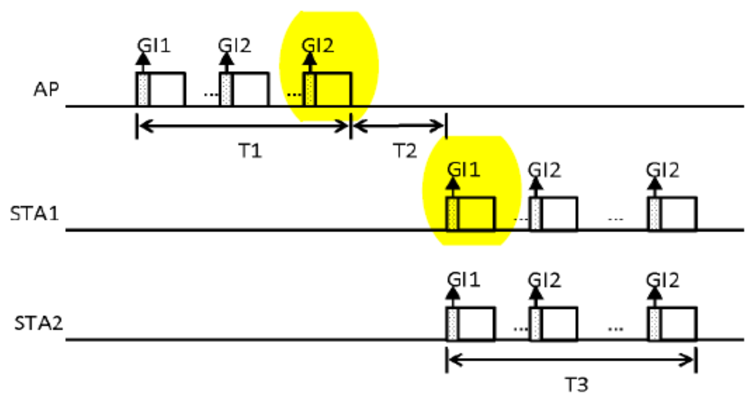


Figure 1: Use of same GI with trigger frame

> The first frame indicates the scheduling information on OFDMA transmission. The guard interval of the first part of the first frame is set at a predetermined value (GI1). And, depending on situation, the AP chooses to use another guard interval (GI2) for the rest of the first frame (a second part of the first frame). The situation may include multi-path delay profile of the received signal, different propagation delay to and from multiple different stations, accuracy of timing alignment capabilities of participating stations, and so on. Moreover, in one situation, GI2 value is the same with GI1 value. In another situation, GI2 value is different from GI1 value.
>
> When the participating station receives the first frame and identifies that the participating station is supposed to transmit its own frame T2 time after receiving the first frame, the participating station uses guard interval of GI1 for the first part of its own second frame, which interval is predetermined, and uses the same guard interval with that of the second part of the first frame for the rest of its own second frame when the participating station transmits the second frame in OFDMA manner.

ATLAS-00014371 (emphasis added).

[redacted]

12.3.12The '513 Provisional Fully Supports '513 Claim 8, 16, 17

1495. Claim 8 of the '513 Patent recites: "the apparatus of claim 7, wherein the second set of OFDM symbols comprises a legacy short training field, a legacy long training field, a legacy signal field, and a high efficiency signal A field, and wherein the third set of OFDM symbols comprises a high efficiency long training field." Claims 16 and 17 are related.

1496. The '513 provisional fully discloses that the invention is in the context of 802.11ax, which a POSITA understands uses PPDUs with L-STF, L-LTF, L-SIG, HE-SIG-A, and HE-LTF fields, for example:

> During the standardization activities of IEEE 802.11 Task Group ax, OFDMA (Orthogonal Frequency Division Multiple Access) technology is introduced for multiple access scheme to improve network efficiency. OFDMA is a technology that allows multiple stations to transmit frames simultaneously using non-overlapping frequency-time resource.

ATLAS-00014370 (emphasis added); *see also* evidence and analysis for '513 claims 7, 11 above.

12.3.13The '513 Provisional Fully Supports '513 Claim 14

1497. Claim 14 of the '513 Patent recites: "the method of claim 9, wherein a payload of the downlink frame comprises the indication of the first CP length."

1498. The '513 provisional fully discloses that the payload of the downlink frame indicates the CP length used by at least a portion of the payload of the uplink frame, for example:

[redacted]

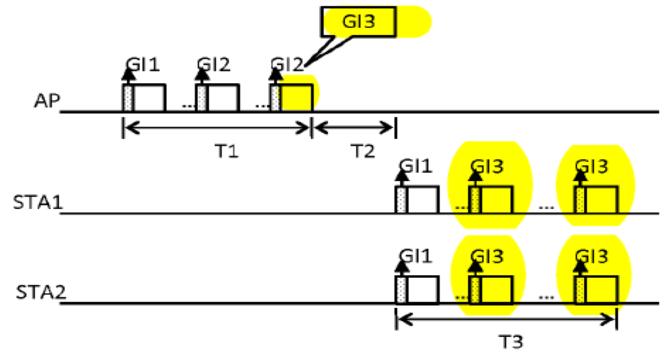


Figure 4: Indication of GI in the trigger frame

The first frame indicates the scheduling information on OFDMA transmission. The guard interval of the first part of the first frame is set at a predetermined value (GI1). And, depending on situation, the AP chooses to use another guard interval (GI2) for the rest of the first frame (a second part of the first frame). The situation may include multi-path delay profile of the received signal, different propagation delay to and from multiple different stations, accuracy of timing alignment capabilities of participating stations, and so on. The first frame further comprises an information on the guard interval that the participating stations shall use (GI3) excluding the first part of the second frames, wherein the duration of the first part is predetermined, and wherein the first part of the second frames shall use a predetermined guard interval (GI1) that is the same with that of the first part of the first frame.

When the participating station receives the first frame and identifies that the participating station is supposed to transmit its own frame T2 time after receiving the first frame and also identifies the guard interval value that the participating station shall use (GI3), the participating station uses guard interval of GI1 for the first part of its own second frame, which interval is predetermined, and uses the indicated guard interval (GI3) from the first frame for the rest of its own second frame when the participating station transmits the second frame in OFDMA manner.

ATLAS-00014374 (emphasis added). The '513 provisional similarly discloses:

A method is provided for synchronizing OFDM symbol boundary when multiple users transmit frames simultaneously in OFDMA way. The method comprises receiving at a first station a first frame, wherein the first frame comprises information on resource allocation that the first station is scheduled to transmit, sending at the first station a second frame, wherein the guard interval of each OFDM symbol of payload part of the second frame is the same as that of payload part of the first frame.

ATLAS-00014369 (emphasis added).

1499. Based at least on the foregoing citations and figures, it is my opinion that the '513 claims are supported by the provisional application.

1500. Dr. Hansen provides an analysis of the '513 priority claims, which I mostly agree with. Hansen Report at ¶55. I particularly agree with Dr. Hansen that the '513 claimed

[redacted]

inventions were "constructively reduce[d] to practice by filing U.S. Provisional Application No. 62/061,503 on October 8, 2014." *Id.*

12.4 Claim Construction

1501. The Court issued a claim construction order on February 8, 2023 ("Claim Construction Order" or "Markman Order"). Dkt. No. 117. I have applied the constructions therein. For terms the court did not construe, I have applied the plane and ordinary meaning to a person of ordinary skill in the art at the time of invention.

1502. With respect to the '513 Patent, the Court construed the following terms:

Term or phrase	Court's Construction
"wherein at least a portion of the payload of the uplink frame is associated with the first guard interval length" (claim 1)	"wherein some or all of the payload of the uplink frame uses the first guard interval length"
"wherein at least a portion of the payload of the uplink frame is associated with the first CP length" (claim 9)	"wherein some or all of the payload of the uplink frame uses the first CP length"
"wherein at least a portion of the legacy header is associated with a second CP length" (claim 10)	"wherein some or all of the legacy header uses a second CP length"
"wherein at least a portion of the respective non-legacy header is associated with the first guard interval" (claim 16)	"wherein some or all of the respective non-legacy header uses the first guard interval"

Dkt. 117 at 40.

1503. In its analysis, the Court cited the '513 Patent at 17:10-39, Figure 8, 3:62-67, and 13:14-34 and noted that, "particularly when read in light of the specification, this claim language is reasonably clear' wherein 'at least a portion' can be understood as referring to some or all, and 'associated' can be understood as referring to the recited attribute being used." *Id.* at 39. Thus, the Court rejected Defendants' indefiniteness positions.

[redacted]

12.5 Overview of Dr. Hansen's Alleged '513 Prior Art

1504. Dr. Hansen analyzes five references in connection with the '513 Patent: (1) U.S. Patent Publication 2015/0117363 to Zhigang Rong et al. ("Rong", Hansen Ex. 513-2); (2) U.S. Patent Publication 2016/0072654A1 to Jinsoo Choi et al. ("Choi", Hansen Ex. 513-3); (3) "Variable Guard Interval for OFDM Based WLANs," by Suvra S Das et al. ("Das", Hansen Ex. 513-4); (4) U.S. Patent Publication 2015/0063258 to Simone Merlin et al. ("Merlin", Hansen Ex. 513-5); and (5) U.S. Patent 10,034,288 to Jinyoung Chun et al. ("Chun", Hansen Ex. 513-6). Hansen Report at ¶¶2404-2988. I provide an overview of each below.

12.5.1 Rong

1505. Rong is titled "System and Method for Setting Cyclic Prefix Length." Rong at Title Page. Rong generally relates to "setting cyclic prefix length" in the context of WLAN networks. *Id.* at [0002]. More specifically, Rong teaches that an AP transmits "scheduling information"—not a "trigger frame"—to a STA. *Id.* at [0006]-[0007]. That "scheduling information is configured to prompt an adjustment to a first length of a first cyclic prefix" by the STA. *Id.* at [0007]. The STA then transmits a response to the AP using "the first length of the first cyclic prefix determined in accordance with the scheduling information." *Id.* Because the "cyclic prefix length is adjustable" and "a short cyclic prefix is used" "when a long cyclic prefix is not needed," this "reduc[es] communications overhead." *Id.* at [0011].

1506. Rong Figures 6a (for the AP) and 6b (for the STA) are illustrative. First, in step 605 the AP transmits UL scheduling information that "may include information about a resource(s) scheduled for the station, as well as an indicator of CP length the station is to use for UL transmissions." Rong at [0051], Fig. 6A. "The indicator of the uplink CP length can be in the form of a number of bits operating as an index pointing to a CP length value in a set of possible options." *Id.* at [0048]. Second, in step 655 the STA receives the UL scheduling information and adjusts the CP length for its responsive transmissions

[redacted]

according to the indicator from the UL scheduling information in step 660. *Id.* at [0049], Fig. 6B. Finally, in step 665 the STA will transmit to the AP using the indicated CP length. *Id.* at [0049], [0051], Fig. 6B.

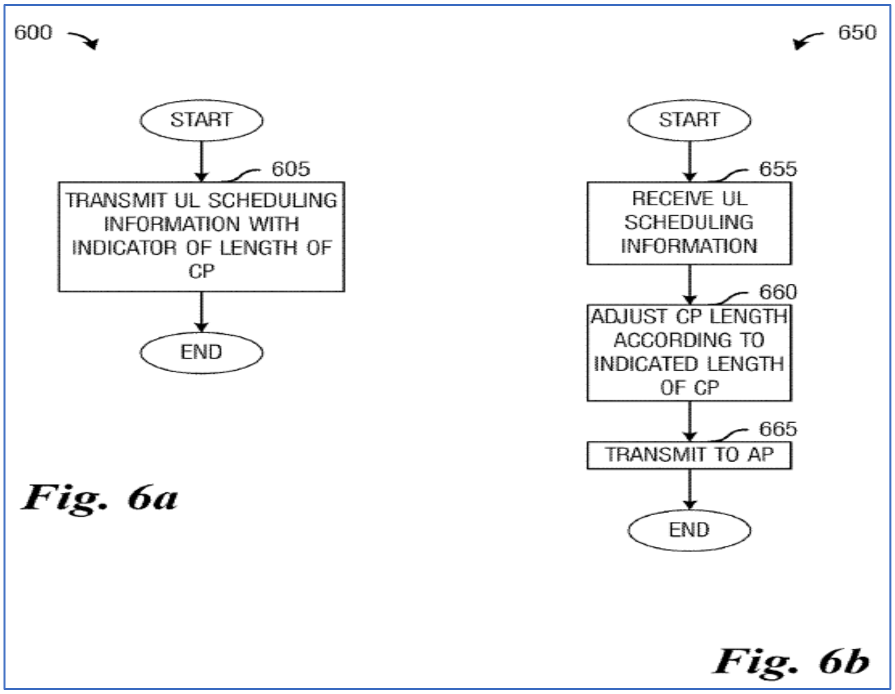


Fig. 6a

Fig. 6b

1507. Importantly, unlike the '513 Patent, Rong never discloses a "trigger frame." Rong's UL scheduling information is not a "trigger frame" and Rong never refers to it as such. Nor does Rong disclose the structure of the uplink frame; for example, Rong is silent as to whether it has a header and a payload. Finally, Rong does not teach that different portions of the uplink frame use different guard intervals.

1508. Dr. Hansen has not proven that Rong is prior art to the '513 Patent. Rong was filed on October 22, 2014 (which is about two weeks after the '513 Patent's October 8, 2014 priority effective filing date). But Rong claims priority to a provisional application filed on October 24, 2013. Thus, Rong is only prior art under post-AIA §102(a) if Dr. Hansen proves that the disclosures from Rong that he relies upon are fully supported by Rong's October 24, 2013 provisional application. Yet Dr. Hansen never performs this analysis.

[redacted]

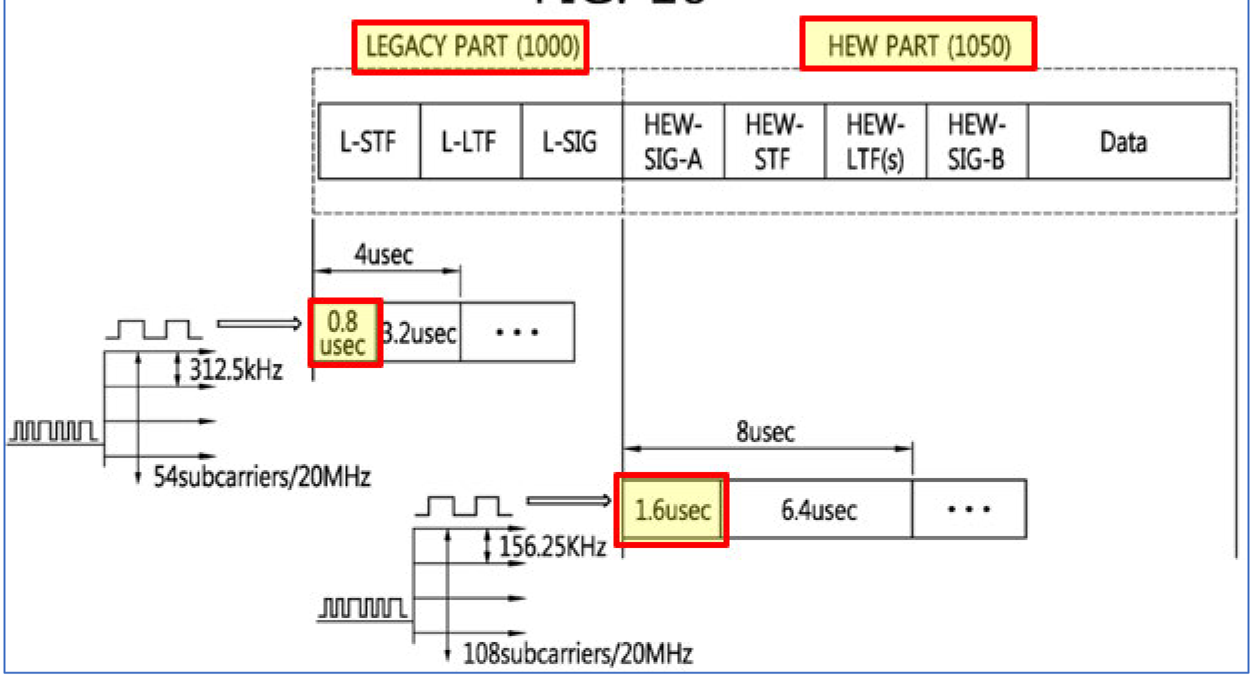
Accordingly, Dr. Hansen has not met his burden to prove that Rong is prior art to the '513 Patent.

12.5.2 Choi

1509. Choi is titled "Method and Device for Transmitting Data Unit." Choi at Title Page. Choi generally relates to the 802.11ax frame structure. Specifically, Choi discloses a HE-PPDU with a "legacy part" and a "HEW part." The legacy part may have a guard interval of *e.g.*, 0.8µs, while the HEW part may have a longer guard interval of *e.g.*, 1.6µs or 3.2µs. *See* Choi at [0097]-[0100], [0116]-[0130]. And "the HEW-STF sequence may include information on the length of a used GI." *Id.* at [0099]. Alternatively, the device may detect the guard interval using an "OFDM numerology check." *See id.* at [0124]. Further, "the length of the TGI [guard interval time] may be adjusted depending on communication environments" such that an increased guard interval may "accordingly increase transmission coverage of the HEW PPDU." *Id.* at [0118].

1510. Annotated Figure 10 best illustrates these teachings from Choi:

FIG. 10



[redacted]

1511. Importantly, Choi never discloses any "trigger frame," and certainly never teaches or suggests that the trigger frame will indicate the guard interval of a subsequent UL frame. At best, Choi teaches that a HEW-STF field of a DL frame can indicate the guard interval of portions of <u>that same</u> DL frame.

1512. Dr. Hansen has not proven that Choi is prior art to the '513 Patent. Choi was filed on October 20, 2015 (which is more than a year after the '513 Patent's October 8, 2014 priority effective date). But Choi claims priority to a provisional application filed on May 7, 2013 and a Korean PCT Application filed on May 7, 2014. Thus, Choi is only prior art under post-AIA §102(a) if Dr. Hansen proves that the disclosures from Choi that he relies upon are fully supported by either of Choi's May 7, 2013 provisional application or Choi's May 7, 2014 Korean PCT Application. Yet Dr. Hansen never performs this analysis. Accordingly, Dr. Hansen has not met his burden to prove that Choi is prior art to the '513 Patent.

12.5.3 Das

1513. Das is a paper titled "Variable Guard Interval for OFDM based WLANs." Das at 2381. Das proposes "the dynamic selection of guard interval in OFDM based wireless local area network systems" like those used in IEEE 802.11a/g. *Id.* at 2381. Das explains that, in those systems, "the header OFDM symbol must have a fixed guard interval," while the payloads for different devices "may have different GI for the data portion." *Id.* Thus, Das proposes "the simultaneous existence of variable guard intervals [for each device using the same] access point (AP)" (*i.e.*, the STAs in a BSS do not all use the same guard interval). *Id.*

1514. In one embodiment of Das's system, "the AP estimates the required GI [guard interval] and informs the SS [subscriber station] about the required GI." Das at 2382. More specifically, "the length of the chosen guard interval can be indicated in some header (SIGNAL field in IEEE 802.11a/g systems)." *Id.* Das's simulations show that "implementing variable guard interval in OFDM based WLANs [] can significantly

[redacted]

enhance the throughput without any compromise in the bit error rate and block error rate performance." *Id.* at 2384.

1515. Das is very different from the '513 Patent. For example, Das discloses a system that allows each STA in the BSS to use a different payload guard interval, while the '513 claims require that each STA in the BSS use the same payload guard interval. Das also fails to teach or suggest key claim limitations like trigger frames, UL OFDMA, and HE-SIG-A fields.

12.5.4 Merlin

1516. Merlin is titled "Methods and Apparatus for Multiple User Uplink." Merlin at Title Page. Merlin relates to "multiple user uplink communications" in 802.11—particularly UL MU-MIMO transmissions. Merlin at [0002]. Figure 7 illustrates the most pertinent disclosures:

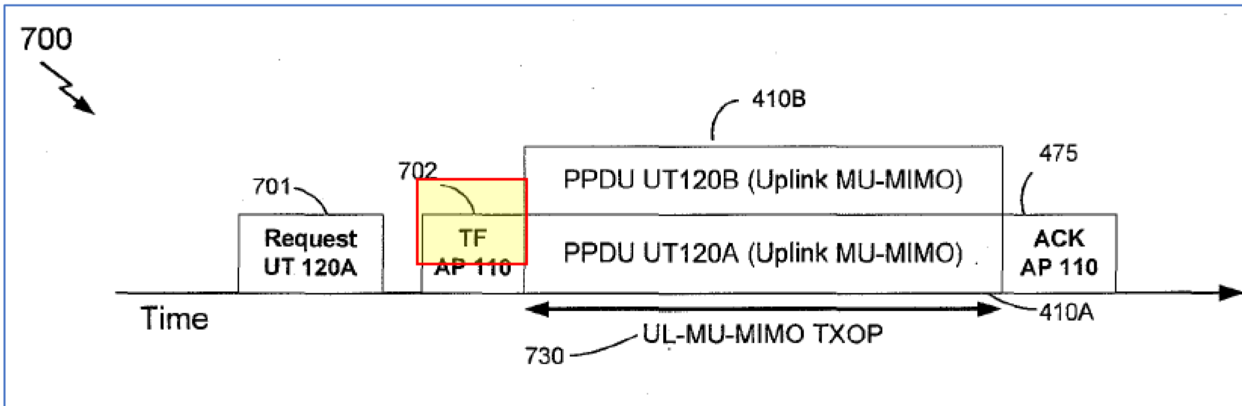


FIG. 7

First, a STA that desires to transmit UL data may send a request 701 to the AP to initialize a UL MU MIMO transmission. *Id.* at [0062]. The AP may respond with a "trigger frame message" 702 granting permission to transmit uplink data to the STA immediately following the trigger frame. *Id.* The STAs then simultaneously transmit UL MU-MIMO PPDU frames to the AP. *See id.* And the AP then transmits a block acknowledgment to the STAs if the UL MU-MIMO PPDUs were successfully received. *Id.* at [0059].

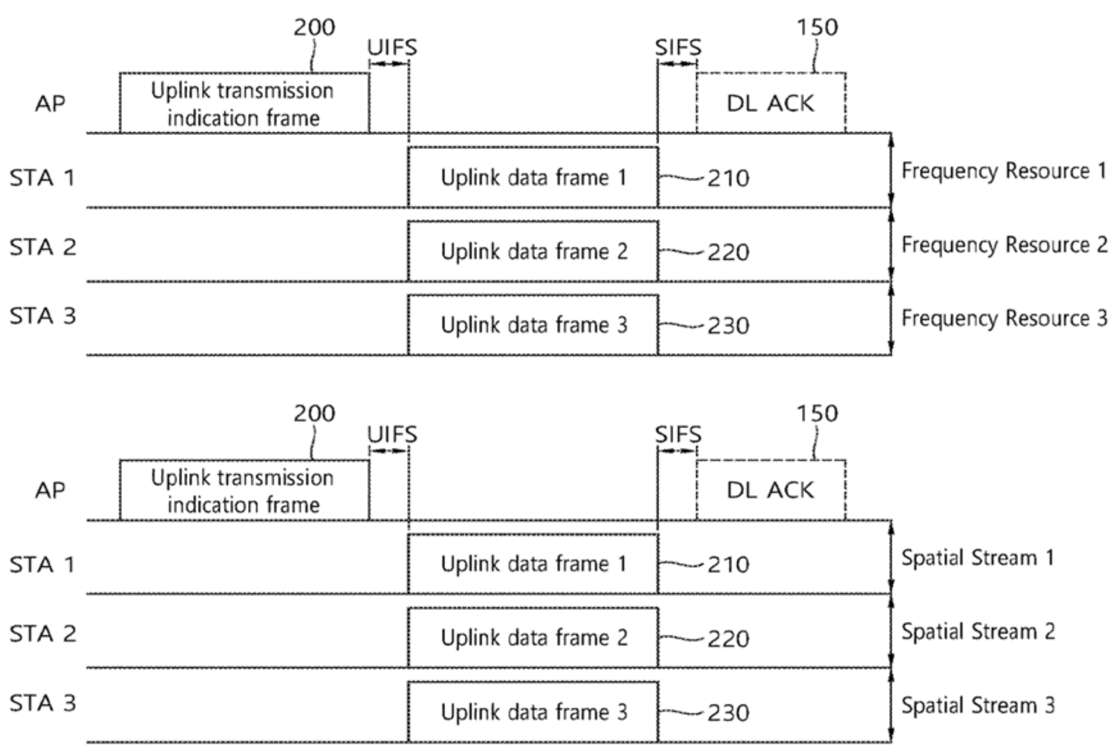
[redacted]

1517. Notably, while Merlin extensively discusses the contents of the trigger frame (Merlin at [0073], Fig. 9), Merlin never teaches that it includes a guard interval length or cyclic prefix duration for the subsequent UL MU transmissions. Indeed, Merlin never uses the terms "guard interval/GI" or "cyclic prefix/CP." Thus, Merlin is very different from the '513 claims in that it never teaches or suggests that the trigger frame indicates the guard interval length for subsequent UL MU transmissions.

12.5.5 Chun

1518. Chun is titled "Method and Apparatus for Transmitting Frame in Wireless LAN." Chun at Title Page. Chun generally relates to WLAN uplink multi-user ("UL MU") transmissions. Figure 2 of Chun illustrates two such UL MU transmissions, with UL MU OFDMA transmissions at top and UL MU MIMO transmissions at bottom:

FIG. 2



[redacted]

Id., Fig. 2.

1519. As can be seen, Chun's Access Point ("AP") first sends an uplink transmission indication frame 200 to each of stations 1-3 ("STAs"). Chun at 6:17-21. The uplink transmission indication frame 200 includes one or more of the following: "[1] information indicating each of the multiple STAs or a group of multiple STAs performing the uplink transmission, [2] MCS (modulation and coding scheme) information being used for the transmission of uplink data by each of the multiple STAs, [3] information on the size of the uplink data that are available for transmission by each of the multiple STAs, and [4] information on a TXOP (transmission opportunity) for the uplink transmission." *Id.* at 6:30-38. Notably, unlike the '513 Patent, Chun's uplink transmission indication frame 200 does not indicate any guard interval or cyclic prefix length. *Id.* Each of STAs 1-3 then decode the uplink transmission indication frame 200 and subsequently transmit an uplink data frame 210-230 to the AP according to the particular information in the uplink transmission indication frame 200 ([1]-[4], discussed above). *Id.* at 6:20-24.

1520. In order for Chun's STAs to properly decode the uplink transmission indication frame, those STAs must first know its guard intervals. So prior to transmitting the uplink transmission indication frame, "the AP may transmit the information on the [] guard interval as the system information to the STA through a beacon frame or probe response frame." Chun at 12:49-51. Armed with this "information on the duration of the guard interval" obtained from the beacon frame or probe response frame, Chun's STAs "may perform decoding on the [uplink transmission indication frame] PPDU based on th[at] received information." *Id.* at 12:52-54.

1521. Thus, there are important differences between Chun and the '513 Patent. As alluded to above, Chun does not use a "trigger frame" that allocates resources to indicate the guard interval for subsequent uplink multi-user transmissions so they will be synchronized. Instead, Chun uses a very different "beacon frame or probe response frame" to indicate the guard interval for downlink multi-user transmissions so the STAs can properly decode

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them. Thus, when compared to the '513 Patent, Chun uses a different mechanism to indicate different guard intervals for a different purpose.

1522. Dr. Hansen has not proven that Chun is prior art to the '513 Patent. Chun was filed as a PCT application of February 16, 2015—nearly four months after the '513 Patent's October 8, 2014 priority effective filing date. Chun at Title Page. But Chun claims priority to two provisional applications filed before the '513 Patent—on March 3, 2014 and July 21, 2014, respectively. *Id.* Thus, Chun is only prior art under post-AIA §102(a) if Dr. Hansen proves that the disclosures from Chun that he relies upon are fully supported by either of Chun's provisional applications. Yet Dr. Hansen never performs this analysis. Accordingly, Dr. Hansen has not met his burden to prove that Chun is prior art to the '513 Patent.

1523. I note that this issue of whether Chun is prior art was raised in the IPR filed by Sercomm. Like Dr. Hansen, Sercomm's expert alleged that Chun was prior art to the '513 Patent. Yet Sercomm's expert went far further than Dr. Hansen and at least attempted to show that the relevant Chun passages were supported by Chun's provisionals; Dr. Hansen never attempted this analysis. Notwithstanding, the PTAB found that Sercomm's expert was unable to show that the relevant Chun passages were supported by Chun's provisionals. More specifically, the PTAB found that nothing in Chun's provisionals supported: (1) the AP transmitting the information on the total symbol duration or the guard interval as the system information to the STA through a beacon frame or probe response frame; (2) decoding on the PPDU based on the received information on the total symbol duration and/or the information on the duration of the guard interval; or (3) varying the total symbol duration and/or guard interval duration that is used in the PPDU. IPR2022-01519, Paper 23 (Decision Denying Institution of IPR) at 14. Accordingly, "because Petitioner has not shown that the critical disclosure of Chun [] finds support in the Korean provisionals, Petitioner has not met its burden to prove that Chun is prior art to the '513

[redacted]

Patent as is required by the law" and the PTAB denied the IPR. *Id.* at 16 (internal quotations omitted).

12.6 Dr. Hansen's Alleged '513 Prior Art Does Not Invalidate the Asserted '513 Claims

1524. Dr. Hansen states that each '513 asserted claim is rendered obvious by Rong in view of Choi and/or Das and/or Merlin and/or Chun. Hansen Report at ¶2404. I disagree.

1525. Dr. Hansen's '513 invalidity analysis relies on Rong as the primary reference and each of Choi, Das, Merlin, and Chun as secondary references. *See* Hansen Report at ¶¶2405-2973. With respect to claim 1, for example, Dr. Hansen alleges that Rong primarily teaches or suggests each of limitations [1pre]-[1c], but only alleges that various secondary references teach or suggest limitation 1[d]. *See id.* at ¶¶2405-9 [1pre], ¶¶2432-2468 [1a], ¶¶2491-2494 [1b], ¶¶2537-2553 [1c], ¶¶2563-2598 [1d].

1526. The chart below summarizes Dr. Hansen's '513 invalidity analysis. The rows correspond to my shorthand summary of the claim language, and the columns correspond to Dr. Hansen's five references for the '513 Patent (Rong, Choi, Das, Merlin, and Chun). Anytime Dr. Hansen alleged a reference supposedly teaches or suggests a claim limitation, I placed an "X" at the row/column intersection. Thus, wherever there is no "X," Dr. Hansen concedes the reference fails to teach or suggest a claim limitation. I also identify the references with a red "X" which have not been shown to be prior art to the '513 patent.

'513 Claim Language Shorthand	**Rong**	**Choi**	**Das**	**Merlin**	**Chun**
Prior Art	X	X			X
[1 pre] STA apparatus with memory and processor	X		X		X
[1a] receive trigger frame indicating GI for all STAs and RU allocation	X				X
[1b] generate MU UL frame with payload and header	X	X		X	X
[1c] transmit MU UL frame using allocated RU	X				X

[redacted]

'513 Claim Language Shorthand	Rong	Choi	Das	Merlin	Chun
[1d] payload portion uses GI from trigger frame		X	X		X
[2] trigger frame indicates when to transmit UL frame	X			X	X
[3] transmit UL frame a predetermined time after trigger frame	X			X	X
[4] UL OFDMA	X				X
[5] UL header uses different GI	X	X	X	X	X
[6] UL payload has 1st set of OFDM symbols that uses GI from trigger frame	X	X	X		X
[7] UL header has 2nd set of OFDM symbols with different GI & 3rd set of OFDM symbols with GI from trigger frame	X	X			X
[8] UL header uses 2nd set of OFDM symbols for L-STF, L-LTF, L-SIG and HE-SIG-A and 3rd set of OFDM symbols for HE-LTF	X	X			X
[9pre] STA method	X		X		X
[9a] receive DL frame indicating CP for all STAs and RU allocation	X				X
[9b] generate MU UL frame with payload	X	X		X	X
[9c] transmit UL frame using allocated RU	X				X
[9d] payload portion uses CP from DL frame		X	X		X
[10] UL header uses different CP	X	X	X	X	X
[11] UL payload has 1st set of OFDM symbols that uses CP from DL frame; UL header has 2nd set of OFDM symbols with different CP	X	X	X		X
[12] UL OFDMA	X				X
[13] transmit UL frame a predetermined time after DL frame	X			X	X

[redacted]

‘513 Claim Language Shorthand	Rong	Choi	Das	Merlin	Chun
[14] DL payload indicates CP			X		X
[15pre] AP method	X		X		X
[15a] determine GI for all STAs in MU UL; create trigger frame indicating GI for all STAs and RU allocation	X				X
[15b] transmit trigger frame					X
[15c] process UL frames with payload portions that use GI from trigger frame	X	X		X	X
[16] UL frames have non-legacy headers, a portion of which uses GI from trigger frame					X
[17] a second portion of non-legacy headers uses different GI	X	X			X
[18] trigger frame indicates when to transmit UL frame	X			X	X
[19] UL OFDMA	X				X

12.6.1 Rong, Choi, and Chun Are Not Prior Art

1527. As explained above in §13.4 Overview of Dr. Hansen’s Alleged ‘513 Prior Art, Dr. Hansen has not proven that any of Rong, Choi, and Chun are prior art to the ‘513 Patent. The above chart shows that, if Rong, Choi and Chun are eliminated, Dr. Hansen has not even alleged (much less proven by clear and convincing evidence) that all the claim limitations are taught or suggested by Das and Merlin. Thus, because Rong, Choi and Chun are not prior art, Dr. Hansen’s ‘513 invalidity analysis necessarily fails.

12.6.2 None of Dr. Hansen’s ‘513 References Teach Or Suggest A “Trigger Frame” or “Downlink Frame For Allocating Resources For An Uplink Multi-User Transmission” that “Solicit[s] the UL MU Transmission” and “Indicat[es] A First Guard Interval Length” (1[A], 9[A], 15[A])

1528. Each of the ‘513 claims require a “trigger frame” or “downlink frame” transmitted by an access point that “solicit[s] the UL MU transmission” and “indicat[es] a first guard interval length” or “first cyclic prefix (CP) length.” For example, independent claim 1[A] of the ‘513 Patent recites “a trigger frame transmitted by an access point [that includes] an

[redacted]

indication of a first guard interval length" and "solicits the UL MU transmission." '513 at 21:27-31. Similarly, independent claim 15[A] recites a "trigger frame [that] includes information indicating the first guard interval" and "solicits the UL MU transmission." *Id.* at 22:55-59. And while independent claim 9[A] does not require a "trigger frame" or "guard interval," it recites something similar: "a downlink frame from the access point" "for allocating resources for an uplink multi-user transmission and for soliciting the UL MU transmission" that includes "an indication of a first cyclic prefix (CP) length." *Id*. at 22:12-17.

1529. Dr. Hansen cites evidence that he asserts proves Rong and Chun disclose these limitations. Hansen Report at ¶¶2432-2489 (1[a]), ¶¶2889-2894 (9[a]), ¶¶2942-2948 (15[a]). He does not cite any evidence proving that Choi, Das, or Merlin disclose these limitations. *Id.* But neither Rong nor Chun teach or suggest these limitations, as described below.

1530. The '513 Patent provides a lengthy description of a "trigger frame." It begins by explaining trigger frames in the context of "IEEE 802.11 Task Group ax," where "OFDMA technology is introduced to provide a multiple access scheme to improve network efficiency." '513 at 2:33-35. It further explains that, in 802.11ax's "OFDMA transmission, if frames transmitted by different stations are not synchronized at a receiver side (e.g., at an access point), the receiver may have difficulty correctly decoding the frames." *Id.* at 2:40-43. So 802.11ax's solution to that synchronization problem is to use a "trigger frame [] to facilitate maintaining of synchronization among the participating stations for MU simultaneous transmission in OFDMA." *Id.* at 2:43-46.

1531. More specifically, the '513 Patent teaches "a trigger frame may be a frame sent by an access point (AP) that seeks data, control, or management frame response(s) from stations that participate in a subsequent uplink (UL) MU frame." '513 at 2:47-50. The trigger frame "initiate[s] the MU simultaneous transmission in OFDMA." *Id.* at 2:50-52. Further, the "trigger frame may include some or all of the following features: (a) a list of

[redacted]

STAs that an AP seeks a response from; (b) resource allocation information for each STA (e.g., a sub-band assigned to each STA); and/or (c) attributes of the expected UL MU frame, such as the duration, bandwidth, etc." *Id.* at 2:52-58. The '513 Patent also teaches that a trigger frame "include[s] information for a guard interval (GI) duration [] to be used for at least some symbols of an UL frame." *Id.* at 2:61-65. Persons of skill understand a "trigger frame" or "downlink frame [] for soliciting the UL MU transmission" according to the teachings of the '513 Patent.

1532. The concept of a trigger frame was introduced in the 802.11 family of protocols when the 802.11 AX Task Group begun its work on a High Efficiency (HE) mode within the High Efficiency WLAN Study Group (HEW SG). The HEW SG was formed in 2013 and many technical presentations and comments about trigger frames can be found on the group's web site throughout the years. *See* High Efficiency (HE) Wireless LAN Task Group, *available at* https://www.ieee802.org/11/Reports/tgax_update.htm. Trigger frames in 802.11ax are primarily used to trigger UL MU transmissions from multiple STAs. Thus, "trigger frames" were well-understood by POSITAs at the time and POSITAS did not confuse "trigger frames" with other frames.

1533. Although unclear from his report due to the mere block quoting and complete lack of analysis, Dr. Hansen presumably identifies Rong's scheduling information as the claimed "trigger frame"/"downlink frame [] for soliciting the UL MU transmission." *See* Hansen Report at ¶¶2432-2467 (re 1[A], citing passages that mention "scheduling information" 67 times). However, Dr. Hansen has not met his burden to show that Rong's scheduling information satisfies these claim elements.

1534. As an initial matter, Rong never refers to its scheduling information as a "trigger frame." Indeed, Rong never once uses the word "trigger." *See generally* Rong. Instead, Rong describes its scheduling information as "includ[ing] information about a resource(s) scheduled for the station, as well as an indicator of CP length the station is to use for UL transmission." Rong at 8:10-13. But Rong never teaches that its scheduling information

[redacted]

initiates and solicits the UL MU transmission for the purpose of maintaining synchronization among the participating stations, as per the '513 Patent. This is not an accident. While scheduling information (like that described in Rong) is helpful and often required for successful concurrent UL MU transmissions, communicating such scheduling information and soliciting/triggering UL MU transmissions at a specific time are two different tasks. For example, scheduling information may be shared with STAs for multiple future UL MU transmissions, and then explicit solicitation of such transmissions may be triggered by multiple trigger frames over a period of time to guarantee synchronization, while the same scheduling information shared earlier may be used for all the UL MU transmissions.

1535. Thus, it is my opinion that Rong does not teach or suggest these claim limitations.

1536. Turning now to Chun, although again unclear due to the lack of specificity and analysis in his report, Dr. Hansen presumably identifies the same thing for each of those claim elements: Chun's uplink transmission indication frame. *See* Hansen Report at ¶¶2469-2489 (re 1[A], citing passages that mention "uplink transmission indication/instruction frame" numerous times).

1537. But Chun's uplink transmission indication frame does not "indicate[] a first guard interval length," as claimed. Instead, Chun teaches its uplink transmission indication frame includes other information:

> For example, **<u>the uplink transmission indication frame 200 may include</u>** at least one of information indicating each of the multiple STAs or a group of multiple STAs performing the uplink transmission, MCS (modulation and coding scheme) information being used for the transmission of uplink data by each of the multiple STAs, information on the size of the uplink data that are available for transmission by each of the multiple STAs, and information on a TXOP (transmission opportunity) for the uplink transmission.

Chun at 6:30-38 (emphasis added). Nowhere in that passage (or anywhere else) does Chun teach the uplink transmission indication frame indicates a guard interval.

[redacted]

1538. It comes as no surprise that Chun's uplink transmission indication frame does not indicate a guard interval. Chun instead teaches the guard interval is indicated via an entirely different mechanism—namely, a beacon frame or probe response frame:

> [T]he duration of the guard interval (GI) ($T_{GIS\text{-}HE}$ or $T_{GI\text{-}HE}$) may be changed, and such information may be transmitted by the AP. For example, **the AP may transmit the information on [] the guard interval as the system information to the STA through a beacon frame or probe response frame**, and so on.

Chun at 12:46-52 (emphasis added). But a beacon frame and probe response frame are **not** the claimed "trigger frame" or the "downlink frame for allocating resources for an uplink multi-user transmission."

1539. A beacon frame in the context of 802.11 is a management frame which is periodically transmitted by an access point (AP) to announce the presence of the AP to potential stations (STAs) such as the later may connect to the former, as well as for synchronization purposes. J. Kurose *et. al.*, "Computer Networking: A Top-Down Approach" (6th edition), Pearson, 2012 at pp. 529-530; S. Vasudevan *et. al.*, "Facilitating Access Point Selection in IEEE 802.11 Wireless Networks," in proceedings of IMC 2005 at pp. 293-298. Beacon frames have been used since the onset of the 802.11 family of protocols. In contrast, a trigger frame has been recently introduced in 802.11ax in order to allocate resources and solicit uplink transmissions. *E.g.*, High Efficiency (HE) Wireless LAN Task Group, *available at* https://www.ieee802.org/11/Reports/tgax_update.htm (identifying 40+ 802.11ax submissions relating to trigger frames). Thus, these two types of frames serve entirely different purposes and are entirely different.

1540. A probe response frame in the context of 802.11 is also a management frame that is sent from an AP after receiving a probe request frame from a STA. Specifically, a STA may transmit a probe request frame to an AP during active scanning with the bit rates supported by the STA. In response, APs within reach will respond with a probe response frame. M. Gast, "802.11 Wireless Networks: The Definitive Guide" (2nd edition), O'Reilly Media, 2005 at sections 4.3, 7.2; J. Kurose and K. Ross, "Computer Networking: A Top-

[redacted]

Down Approach" (6th edition), Pearson, 2012 at p. 530. This mechanism is used by APs to determine if a STA may or may not join the network. Probe response frames—like beacon frames, but unlike trigger frames—have been introduced since the early days of 802.11 and serve an entirely different purpose than that of a trigger frame. A POSITA would not confuse beacon and probe response frames with trigger frames. Nor would a POSITA consider that beacon and probe response frames are similar to trigger frames.

1541. For these reasons, it is my opinion that none of Dr. Hansen's '513 references teach or suggest a "trigger frame" or "downlink frame" transmitted by an access point that "solicit[s] the UL MU transmission" and "indicat[es] a first guard interval length" or "first cyclic prefix (CP) length."

12.6.3 None of Dr. Hansen's '513 References Teach Or Suggest An "Uplink Frame" with a "Header" that has a "Set of OFDM Symbols"/"Portion" with the "Guard Interval" from the "Downlink"/"Trigger Frame" and another "Set of OFDM Symbols"/"Portion" with another "Guard Interval" (7, 16-17)

1542. Dependent claim 7 of the '513 Patent requires that "the PHY header is composed of a second set of OFDM symbols and a third set of OFDM symbols and each OFDM symbol in the second set of OFDM symbols includes a guard interval of the second guard interval length and each OFDM symbol in the third set of OFDM symbols includes a guard interval of the first guard interval length." '513 at 21:64-22:3. And '513 dependent claims 16-17 require something similar: "wherein each of the plurality of frames comprises a respective non-legacy header, and wherein at least a portion of the respective non-legacy header is associated with the first guard interval [and] a second portion of the respective non-legacy header is associated with a second guard interval." *Id.* at 23:1-9. Thus, all these dependent claims require an UL frame with a header that has two different portions/sets of OFDM symbols: one portion/set of OFDM symbols in that UL header uses the guard interval/cyclic prefix indicated by the DL trigger frame, while another portion/set of OFDM symbols in that UL header uses a different guard interval/cyclic prefix.

[redacted]

1543. Dr. Hansen cites evidence that he asserts proves Rong, Choi, and Chun disclose these limitations. Hansen Report at ¶¶2792-2830 (7), ¶¶2958-2960 (16), ¶2964 (17). He does not cite any evidence proving that Das or Merlin disclose these limitations. *Id.* But none of Rong, Choi or Chun teach or suggest these limitations, as described below.

1544. Dr. Hansen cites only two sentences from Rong with respect to these claims, neither of which comes close to the claim language:

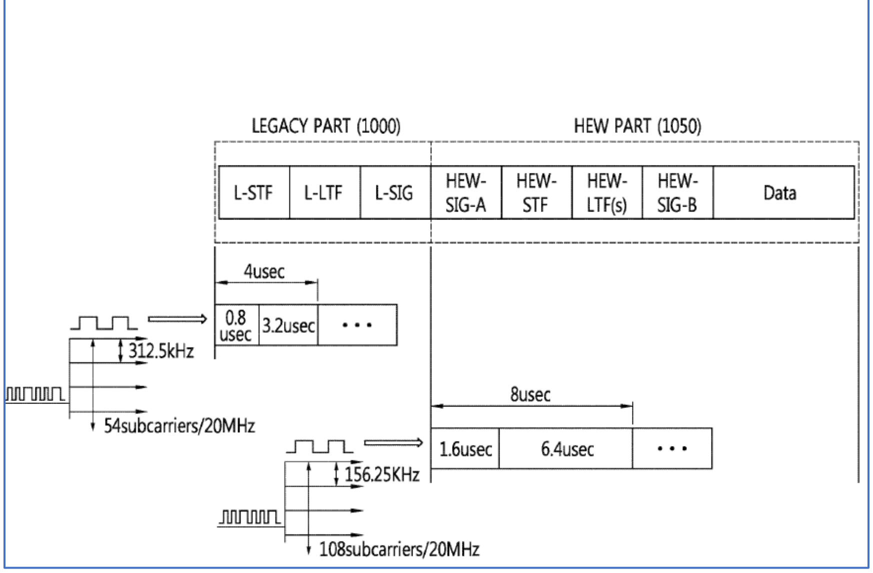
- "One advantage of an embodiment is that the cyclic prefix length is set in accordance with implicit or explicit indicators without requiring timing advance commands, therefore, communications overhead is reduced." Rong at [0010].

- "A further advantage of an embodiment is that the cyclic prefix length is adjustable, therefore, when a long cyclic prefix is not needed, a short cyclic prefix is used, thereby reducing communications overhead." Rong at [0011].

Hansen Report at ¶¶2793-2794. As can be seen, neither sentence teaches or suggests that part of the uplink header will use the guard interval/cyclic prefix from the downlink trigger frame and another part will use a different guard interval/cyclic prefix. Simply noting that the cyclic prefix length can be set implicitly or explicitly and is adjustable does not come close to the claim language.

1545. Dr. Hansen relies heavily on Choi for these claims, and particularly Choi Fig. 10:

FIG. 10



[redacted]

Hansen Report at ¶¶2796-2821 (citing Choi at, *e.g.*, Fig. 10). As can be seen, Choi Fig. 10 shows an HEW PPDU with a legacy header part 1000 that uses a guard interval of .8µs, and a HEW header part 1050 that uses a guard interval of 1.6µs. *See* Choi at Fig. 10, [0013]-[0018]. However, Choi never teaches or suggests that the legacy header part 1000 and certainly not the HEW header part 1050 uses the guard interval indicated by a prior downlink trigger frame (*i.e.*, the claimed "first guard interval length"/"first guard interval"). Rather, Choi discloses variable length guard intervals in the context of properly decoding HEW PPDU frames; Choi never suggests than an AP will instruct STAs what guard interval to use for subsequent UL transmissions, as per the '513 claims.

1546. Dr. Hansen next turns to Chun and cites seven passages, none of which relate to using different guard intervals for the header of an UL frame:

- "In the exemplary embodiment of the present invention, the AP may perform DL MU transmission based on OFDMA, and such transmission may be expressed by using the term DL MU OFDMA transmission. In case the DL MU OFDMA transmission is used, the AP may transmit a downlink frame to each of the multiple STAs through each of the multiple frequency resources within the overlapping time resource." Chun, 4:44-52

- "In case the uplink transmission performed by each of the multiple STAs is respectively performed within different frequency domains, different frequency resources respective to each of the multiple STAs may be allocated as the uplink transmission resource based on OFDMA (orthogonal frequency division multiplexing access). Such transmission method using different frequency resources may also be expressed by using the term UL MU OFDMA transmission method." Chun, 5:59-67

- "The UL MU transmission method may also be used as a meaning that includes the UL MU OFDMA transmission method and the UL MU MIMO transmission method." Chun, 6:6-12

- "Alternatively, in case each of the multiple STAs respectively transmits an uplink frame 210,220, and 230 through different frequency resources based on OFDMA in order to increase the degree of freedom, the transmission duration of the uplink frames being transmitted by each of the multiple STAs may be configured differently." Chun, 6:51-56

- "In case the UL MU transmission is performed, in addition to the difference in the receiving timing, which was mentioned above as a problem that may occur, there also lie problems caused by a difference in the frequency offset, a difference in the receiving power, and so on. More specifically, since each of the multiple STAs has a different oscillator, in case the frequency offsets are indicated differently, it may be difficult to carry out the OFDMA

[redacted]

based UL MU transmission. Additionally, in case the STA does not control the transmission power, the AP may receive the uplink frames, which are transmitted by each of the multiple STAs, at different power levels in accordance with the distance between the AP and the STAs or the channel environment. In this case, it may be difficult for the AP to detect (or search) uplink frames that arc being received at a low (or weak) power level." Chun, 13:52-67

- "More specifically, in case the multiple uplink frames are transmitted via UL MU transmission based on OFDMA, and if the difference in the receiving timing of the multiple uplink frames is within a correction range, an IFFT based transform of the multiple uplink frames may be performed." Chun, 14:35-40
- "In case the difference in the receiving timing is less than or equal to a CP (or GI) length of an OFDM symbol transmitting the multiple uplink frames, it may be determined that the difference in the receiving timing is within the correction range. Conversely, in case the difference in the receiving timing is greater than a GI length of an OFDM symbol transmitting the multiple uplink frames, it may be determined that the difference in the receiving timing is outside of the correction range. A duration of the OFDM symbol may correspond to a sum of a GI duration and a valid symbol duration." Chun, 14:41-52

Hansen Report at ¶¶2822-2829. Instead, these passages simply relate to varied topics like DL MU transmissions, UL MU transmissions like UL MU OFDMA and UL MU MIMO, STAs configuring uplink frames differently, problems associated with frequency offset and different receiving power, and corrections using IFFT based transforms. These passages have nothing to do with the claim language. Further, as discussed above, Chun never teaches or suggests a downlink trigger frame that indicates a guard interval; instead, Chun teaches to use a beacon or probe response frame to identify the guard interval for the system. Chun at 12:46-52, 6:30-38. Thus, Chun cannot teach to use a guard interval from a downlink trigger frame for at least part of an uplink frame's header.

1547. For these reasons, it is my opinion that none of Dr. Hansen's '513 references teach or suggest these dependent claims 7 and 16-17.

[redacted]

12.6.4 None of Dr. Hansen's '513 References Teach Or Suggest An "Uplink Frame" with a "PHY Header" whose HE-LTF Field uses the "First Guard Interval Length" from the "Trigger Frame" and whose L-STF, L-LTF, L-SIG, and HE-SIG A fields use a different "Second Guard Interval Length" (8)

1548. Dependent claim 8 of the '513 Patent requires that "the second set of OFDM symbols comprises a legacy short training field, a legacy long training field, a legacy signal field, and a high efficiency signal A field, and wherein the third set of OFDM symbols comprises a high efficiency long training field." '513 at 22:4-8. Thus, this claim requires that the UL header include specific fields, and that at least the HE-LTF field use the guard interval indicated by a DL prior trigger frame.

1549. Dr. Hansen cites evidence that he asserts proves Rong, Choi, and Chun disclose this claim. Hansen Report at ¶¶2832-2877 (8). He does not cite any evidence proving that Das or Merlin disclose this claim. *Id.* But none of Rong, Choi or Chun teach or suggest this claim, as described below.

1550. Dr. Hansen cites only a single paragraph from Rong with respect to this claim, but it does not come close to the claim language:

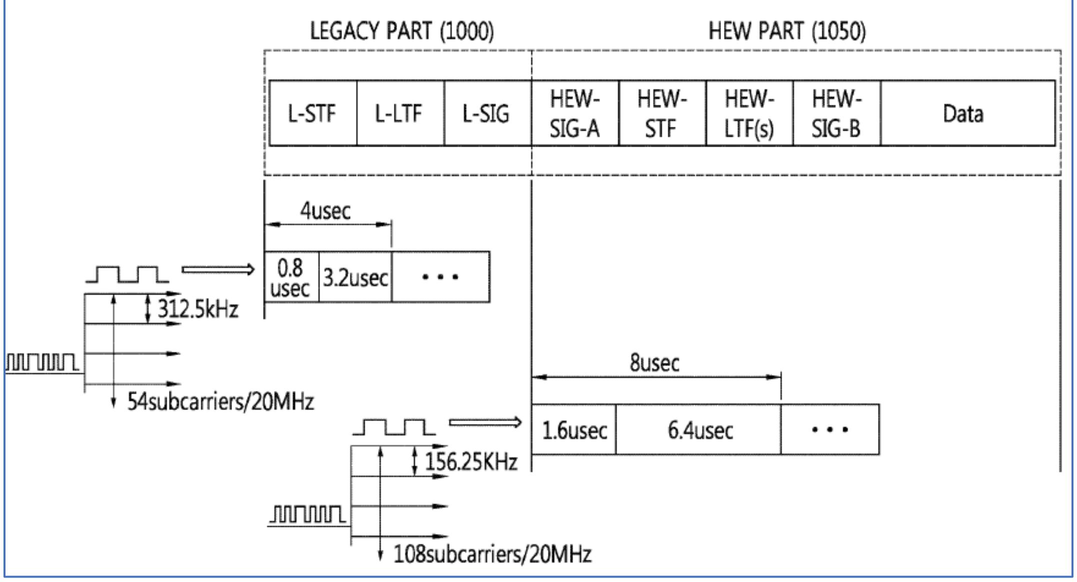
- "The example embodiments presented herein enable the use of OFDMA and/or ULMU-MIMO, making resource usage more efficient. A cyclic prefix for the uplink (CP) is longer than the cyclic prefix for the downlink (CP), which may help to accommodate different propagation delays between different stations and the AP, thereby maintaining the orthogonality among signals from the different stations at the AP. Adaptive cyclic prefix length also helps to maintain low overhead. When OFDMA and/or ULMU-MIMO are not used, longer cyclic prefixes are not necessary and a shorter cyclic prefix may be used, therefore reducing overhead. When OFDMA and/or UL MU-MIMO is used, longer cyclic prefixes are used, but the increased overhead may be compensated for by the additional gain achieved through the use of OFDMA and/or ULMU-MIMO." Rong at ¶ [0056].

Hansen Report at ¶2862. As can be seen, that paragraph does not mention any specific fields in the header, much less teach or suggest what guard intervals they will use. Simply noting concepts like OFDMA, UL MU-MIMO and adaptive cyclic prefix length does not come close to the claim language.

1551. Dr. Hansen relies heavily on Choi for these claims, and particularly Choi Fig. 10:

[redacted]

FIG. 10

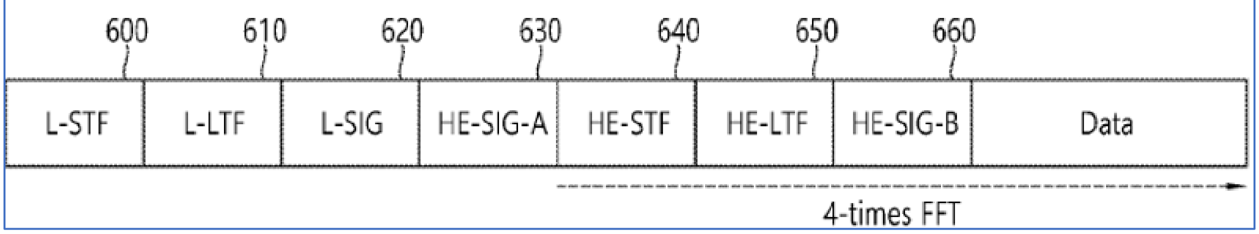


Hansen Report at ¶¶2832-2859 (citing Choi at, *e.g.*, Fig. 10). As can be seen, Choi Fig. 10 shows an HEW PPDU with a legacy header part 1000 that uses a guard interval of .8µs for fields like L-STF, L-LTF and L-SIG, and a HEW header part 1050 that uses a guard interval of 1.6µs for fields like HEW-SIG-A and HEW-LTF. *See* Choi at Fig. 10, [0013]-[0018]. However, Choi never teaches or suggests that HEW-LTF uses the "first guard interval length" indicated by a prior downlink trigger frame, as claimed. Rather, Choi discloses variable length guard intervals in the context of properly decoding HEW PPDU frames; Choi never suggests than an AP will instruct STAs what guard interval to use for subsequent UL transmissions, as per the '513 claims. Also, Choi shows that the HE-SIG-A field uses the 1.6µs guard interval while the L-STF, L-LTF, and L-SIG fields use a different .8µs guard interval; but '513 claim 8 requires that the HE-SIG-A field use the <u>same</u> "second guard interval length" as the L-STF, L-LTF, and L-SIG fields (*i.e.*, .8µs in this case).

1552. Dr. Hansen next turns to Chun and cites various passages relating to the frame structure of a PPDU, including Figure 6:

[redacted]

FIG. 6



Hansen Report at ¶¶2864-2877. As can be seen, Chun Fig. 6 shows a PPDU frame with various fields like L-STF 600, L-LTF 610, L-SIG 620, HE-SIG-A field 630, and HE-LTF 650. However, nothing in Chun—at Fig. 6 or elsewhere—teaches or suggests that HE-LTF 650 uses the "first guard interval length" indicated by a prior downlink trigger frame, as claimed. Indeed, as discussed above, Chun never teaches or suggests a downlink trigger frame that indicates a "first guard interval length"; instead, Chun teaches to use a beacon or probe response frame to identify the guard interval for the system. Chun at 12:46-52, 6:30-38. Thus, Chun cannot teach to use a "first guard interval length" from a downlink trigger frame for at the HE-LTF field of an uplink frame's header.

1553. For these reasons, it is my opinion that none of Dr. Hansen's '513 references teach or suggest dependent claim 8.

12.6.5 A POSITA Would Not Have Combined Rong, Choi, Das, Merlin, and/or Chun

1554. Dr. Hansen alleges that a POSITA would have been motivated to combine Rong with any of Choi, Das, Merlin and/or Chun. Hansen Report at ¶¶2404, 2974-2988. I disagree. Even assuming arguendo that my above analysis is incorrect and there is some combination of Rong with any of Choi, Das, Merlin and/or Chun that discloses every limitation of the '513 claims, a POSITA would not have combined those references (or any subset thereof).

1555. There is no apparent reason—apart from improper hindsight—that would have motivated a POSITA to combine together Rong with any of Choi, Das, Merlin and/or Chun. Rong is a Futurewei patent filed in October 2014 that was primarily invented by Zhigang

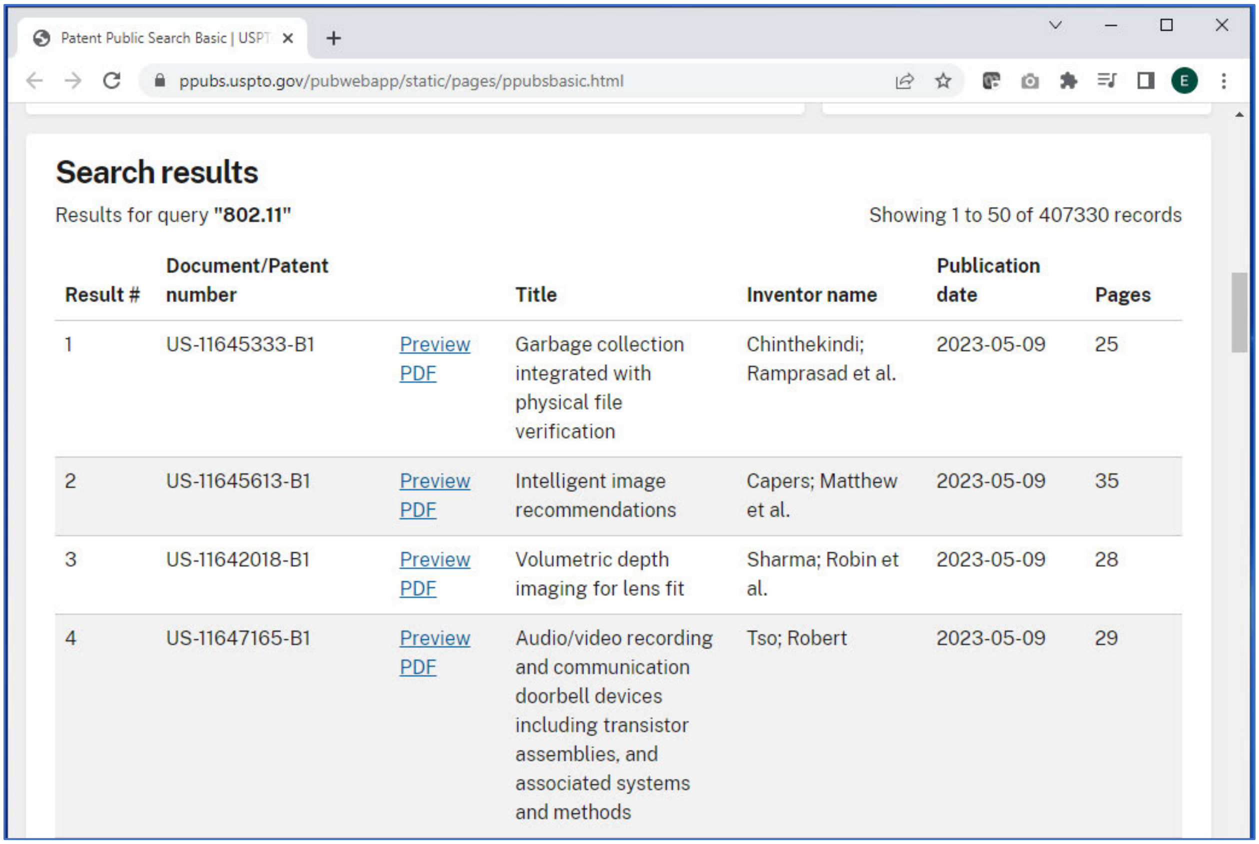
[redacted]

Rong. Rong at title page. Choi is an LG patent application filed in May 2014 that was primarily invented by Jinsoo Choi. Choi at title page. Das is an IEEE paper published in 2005 that was primarily authored by Suvra Das. Das at 2381. Merlin is a Qualcomm patent application filed in August 2014 that was primarily invented by Simone Merlin. Merlin at title page. And Chun is an LG patent filed in September 2014 that was primarily authored by Jinyoung Chun. Chun at title page. As shown above, these five references originate from mostly different companies, were drafted at different times, and have different inventors.

1556. Further, Dr. Hansen's '513 art relates to different technologies. Rong relates to "setting cyclic prefix length." Rong at [0002]. Choi relates to "a method and a device for transmitting a data unit." Choi at [0001]. Das relates to "the dynamic selection of guard interval in Orthogonal Frequency Division Multiplexing (OFDM) based wireless local area network (WLAN) systems." Das at 2381. Merlin relates to "multiple user uplink communication in a wireless network." Merlin at [0002]. And Chun relates to "a method and apparatus for transmitting a frame in a wireless LAN." Chun at 1:19-21. These are disparate technologies, and Dr. Hansen has not shown that a POSITA would not be motivated to combine them.

1557. Dr. Hansen's motivation to combine analysis is superficial. First, Dr. Hansen simply attempts to show that each of his five '513 references are "analogous art" because, like the '513 Patent, each reference "discloses IEEE 802.11 technology." Hansen Report at ¶2975. Notwithstanding, just because references relate to 802.11 standards does not mean a POSITA would have combined them. A search of the USPTO patent database reveals there are 407,330 patents that mention "802.11."

[redacted]



Patent Public Search Basic | USPT

ppubs.uspto.gov/pubwebapp/static/pages/ppubsbasic.html

Search results

Results for query **"802.11"**

Showing 1 to 50 of 407330 records

Result #	Document/Patent number		Title	Inventor name	Publication date	Pages
1	US-11645333-B1	Preview PDF	Garbage collection integrated with physical file verification	Chinthekindi; Ramprasad et al.	2023-05-09	25
2	US-11645613-B1	Preview PDF	Intelligent image recommendations	Capers; Matthew et al.	2023-05-09	35
3	US-11642018-B1	Preview PDF	Volumetric depth imaging for lens fit	Sharma; Robin et al.	2023-05-09	28
4	US-11647165-B1	Preview PDF	Audio/video recording and communication doorbell devices including transistor assemblies, and associated systems and methods	Tso; Robert	2023-05-09	29

https://ppubs.uspto.gov/pubwebapp/static/pages/ppubsbasic.html. By Dr. Hansen's logic, a POSITA would be motivated to make any combination of these 407,330 references. Yet Dr. Hansen fails to show why a POSITA would be motivated to make the particular five-reference combination that he selects. Instead, it appears Dr. Hansen cherry-picked just five of the many references that mention 802.11. This approach uses improper hindsight.

1558. Next, Dr. Hansen argues that each reference is "reasonably pertinent to the problem faced by the ['513 inventor]" so they "would have logically commended themselves to the inventors' attention in considering the problem they were attempting to address." Hansen Report at ¶2977. But Dr. Hansen never identifies what he believes the problem faced by the '513 inventor to be. *Id.*

1559. The '513 Patent explains that "in OFDMA transmission, if frames transmitted by different stations are not synchronized at a receiver side (e.g., at an access point), the receiver may have difficulty correctly decoding the frames." '513 at 1:40-43. And to

[redacted]

maintain that synchronization, all the stations must "maintain the same OFDM symbol duration" and "the OFDM symbols [must be] aligned." *Id.* at 3:34-37. "The aligning of the OFDM symbol durations allows synchronization of OFDM symbol boundaries when the multiple STAs transmit frames simultaneously, such as for OFDMA transmission." *Id.* at 3:43-46. Accordingly, the '513 Patent teaches that "to maintain the same OFDM symbol duration among the participating STAs, the GI periods associated with the OFDM symbols of the participating STAs are aligned." *Id.* at 3:4-37. And the '513 Patent provides "mechanisms [] to enable all participating STAs to use the same GI duration (or the same OFDM symbol duration)." *Id.* at 3:37-39.

1560. None of Dr. Hansen's '513 art relates to the same problem as the '513 Patent. Certainly, Dr. Hansen has not shown as much. Hansen Report at ¶¶2978-2982.

1561. Next, Dr. Hansen goes reference-by-reference and argues that each "teaches, suggest, and motivates a POSITA **to use the disclosed system**." Hansen Report at ¶¶2978-2982 (emphasis added). But it is immaterial whether each of Dr. Hansen's references individually teach, suggest, and motivate a POSITA to use the system disclosed by that individual reference. What matters is whether a POSITA would be motivated **to combine references**. Dr. Hansen's analysis is irrelevant to the obviousness and motivation to combine issues.

1562. Next, Dr. Hansen parrots various legal mantras related to obvious: "predictable results," "simple substitution," "reasonable expectation of success," "finite number of identified, predictable solutions," and "design incentives or other market forces." Hansen Report at ¶2983. But he provides no analysis. What are the predictable results? What are the simple substitutions? Why is there a reasonable expectation of success? What are the finite number of identified, predictable solutions? What are the design incentives or other market forces? Dr. Hansen never explains. *Id.* This superficial analysis does not meet his burden.

[redacted]

1563. Finally, Dr. Hansen identifies three specific combinations that he alleges render the '513 claims obvious. First, Dr. Hansen specifically alleges that it would be obvious to modify Rong (which does not teach (a) an uplink frame with a payload and PHY header, or (b) that a portion of the payload of the uplink frame is associated with the guard interval length indicated by the trigger frame) to instead use Choi's or Das's uplink frame (which alleged do include those things). Hansen Report at ¶¶2984-2986. Basically, Dr. Hansen argues to combine Rong Fig. 4 (top) with Choi Fig. 6 (middle) and Das's teaching of a "variable guard interval for the data portion" to arrive at modified Rong Fig. 4 (bottom):

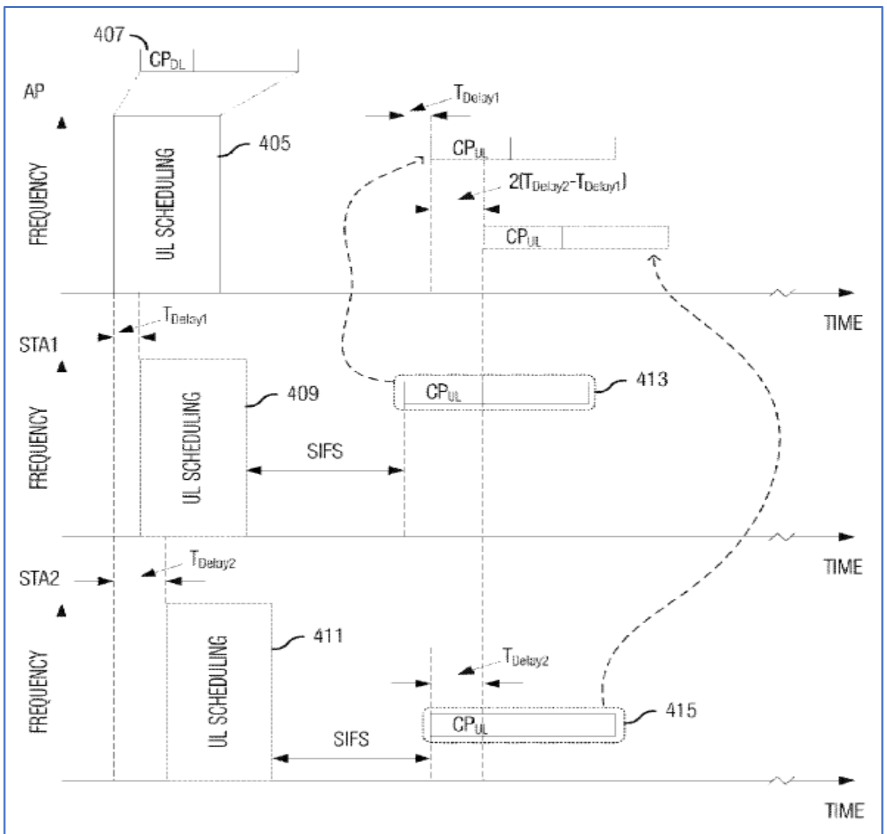


Fig. 4

Rong Fig. 4

+

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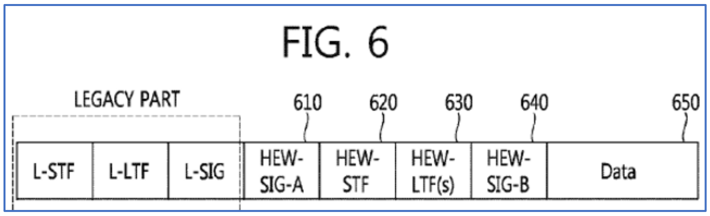
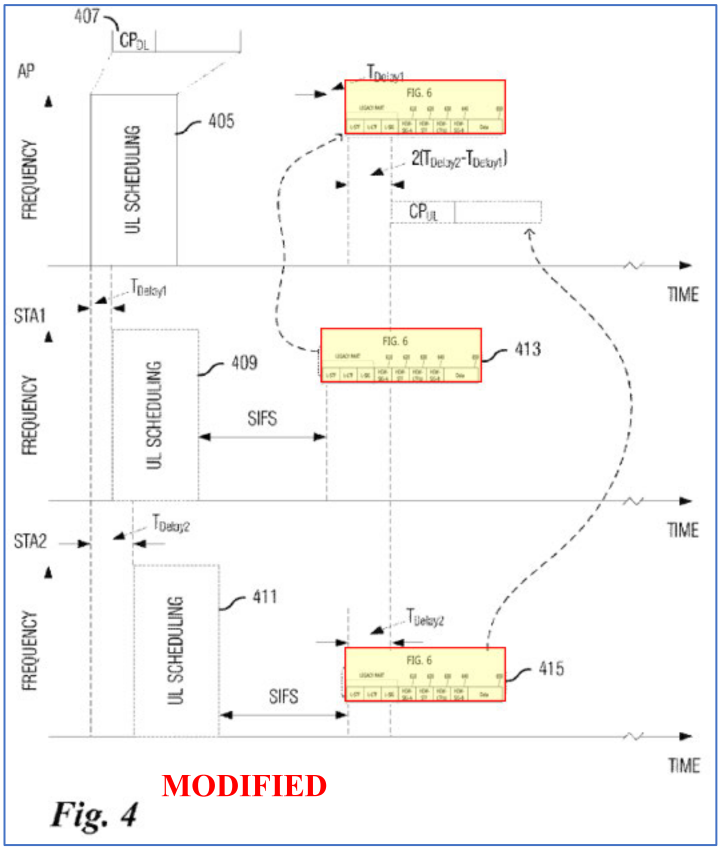


Choi Fig. 6

=



Modified Rong Fig. 4

1564. But even if this modification were made, Rong as modified would still not meet all the limitations of the '513 claims. As shown above, Rong fails to teach or suggest at least '513 1[a], 9[a], and 15[a]. And Dr. Hansen's proposed modification only directly relates to '513 1[b], 1[d] (and also 9[b], 9[d] and 15[c]). Consequently, even this modification to Rong still fails to remedy the deficiencies with 1[a], 9[a], and 15[a] disclosed above; it cannot invalidate the '513 claims.

[redacted]

1565. Second, Dr. Hansen specifically alleges that it would be obvious to combine Rong and Chun. Hansen Report at ¶2987. Yet Dr. Hansen never explains how he would modify Rong to incorporate any of the teachings of Chun (and vice-versa). Accordingly, Dr. Hansen has failed to properly explain this obviousness combination. Further, Dr. Hansen's sole motivation for making this combination is both Rong and Chun allegedly "teach elements 1[b] and 1[d]." *Id.* That is classic hindsight; it is improper to use the fact that two references allegedly teach aspects of the same patent to show that a POSITA would have combined them. Dr. Hansen basically uses the '513 Patent as a roadmap. That is improper.

1566. Also, Rong's method for high efficiency communication is not compatible with Chun's method. Rong's method for high efficiency communications relies on (i) receiving, by a station, via a downlink transmission in accordance with a first CP, scheduling information for an uplink transmission, and (ii) transmitting the uplink transmission using a CP whose value depends on whether a multiple access technique like OFDMA or MU-MIMO is used (in which case a larger CP value than the first CP is selected), or a multiple access technique is not used (in which case the first CP is used). The CP is fixed for each frame. The larger CP in case of multiple access uplink transmissions is proposed to "help accommodate the different propagation delay between different stations and the AP when OFDMA and/or UL MU-MIMO is being used." Rong at 5:47-50.

1567. Chun's method is very different on two fronts. First, it requires an uplink transmission indication frame to explicitly trigger uplink transmissions. Second, it describes a frame structure where the CP varies across the symbols of a single frame, such that the legacy parts of the frame can use the CP from legacy systems, and the high efficiency parts of the frame can use a new CP length to support high efficiency (HE) communication (*see* the HE fields and the corresponding high efficiency mode of communication introduced later by the 802.11ax standard), all the while permitting the new system to remain backward compatible with the legacy system.

[redacted]

1568. In view of the fact that Rong's method and system have nothing to do with the coexistence of a legacy system and a new high efficiency system which uses (by design) a different OFDMA symbol length and thus different CP length, there is no reason whatsoever for a POSITA to combine Chun's variable CP across a single frame technique with Rong. Nor is there any reason to use Chun's frame structure with Rong, since Chun's frame structure explicitly adds HE related fields corresponding to the new CP length that are unrelated to Rong. Said differently, the varying CP within a single frame in Chun is not an improvement over Rong's fixed CP within a single frame; it is an entirely different system than that of Rong, motivated by the new, longer OFDMA symbol duration for the HE mode. Consequently, even this combination still fails to invalidate the '513 claims.

1569. Third, Dr. Hansen specifically alleges that it would be obvious to combine Merlin with any of Rong, Choi, Das, and Chun because of his "analysis of claims 2 and 3 above as to the disclosures of Merlin." Hansen Report at ¶2988. I reviewed ¶¶2610-2615 (claim 2) & ¶¶2646-2651 (claim 3) of Dr. Hansen's Report regarding Merlin and '513 claims 2-3, but did not see any "analysis." Instead, Dr. Hansen simply block quoted Merlin at [0060]-[0061] and Fig. 6—without explanation of any kind—and summarily concluded that "Merlin also discloses this element." *Id.* Moreover, those cited passages from Merlin merely disclose that a STA will wait "a time (T) 406 after the end of the PPDU carrying the **<u>CTX message 402</u>** for the user terminals 12A and 120B to transmit UL-MU-MIMO transmissions. **<u>The T 406 may be a short interframe space (SIFS)</u>**...."

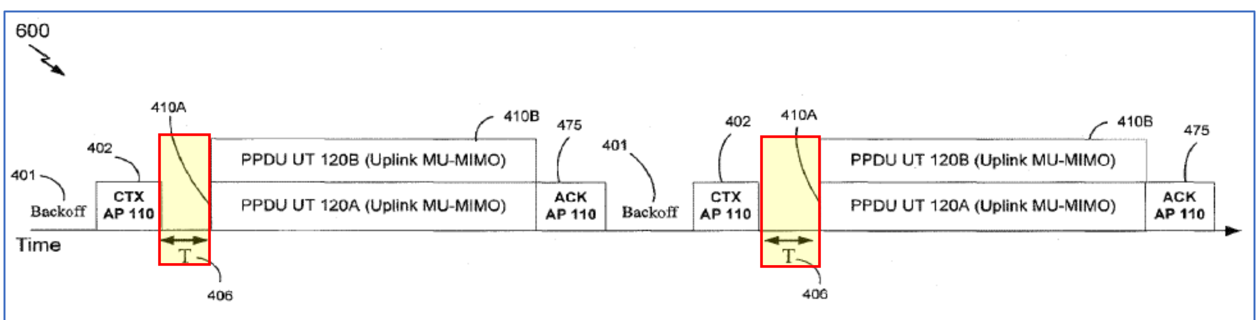


FIG. 6

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Merlin at [0060], Fig. 6 (emphasis added added). In sum, these cited passages simply teach that a STA will wait a SIFS after receiving a Clear to Transmit or "CTX" message before making an UL-MU MIMO transmission. That is very different than '513 claims 2 and 3, which require transmitting an uplink frame after receiving a "trigger frame." Merlin's CTX message is not a "trigger frame." Nor does it indicate a GI to be used by a portion of the payload of the subsequent uplink frame/s. Indeed, Dr. Hansen never alleges otherwise. *See* Hansen Report at ¶¶2432-2489.

13. THE ART REFERENCED IN THE HANSEN REPORT DOES NOT INVALIDATE THE ASSERTED CLAIMS OF THE '679 PATENT

13.1 Overview of the '679 Patent

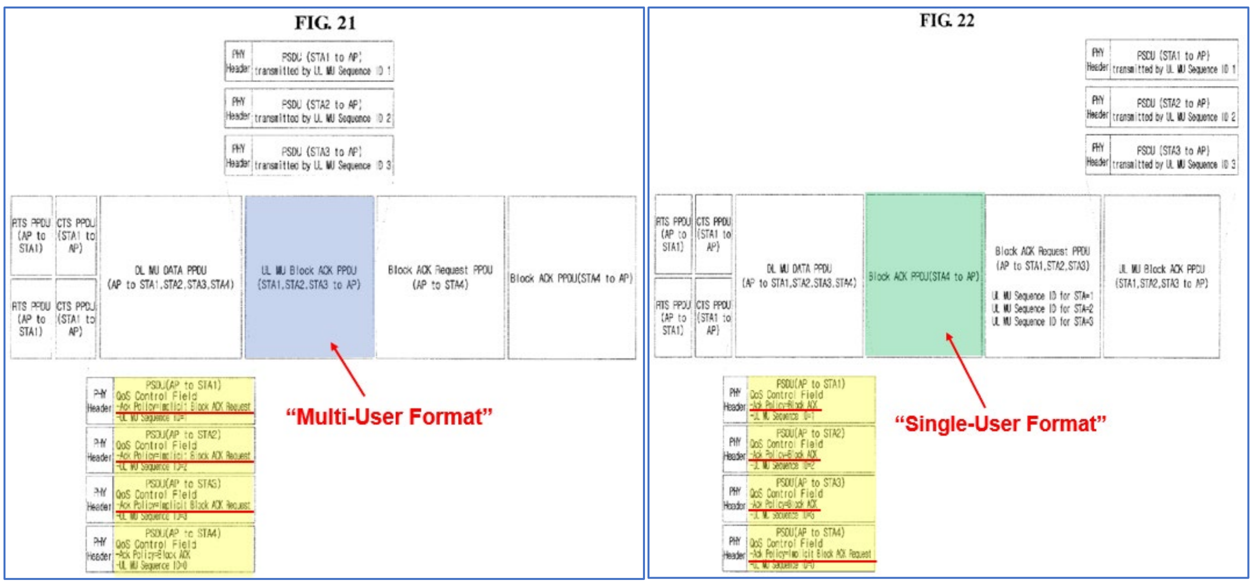
1570. The '679 Patent is titled "Method and Apparatus for Transmitting Response Frame Based On Type In A High Efficiency Wireless LAN." '679 Patent (ATLAS-00014730-14776, Hansen Ex. 679-1) at Title Page. It was invented by Yongho Seok while working on the next-generation Wi-Fi 6 802.11ax standard at Newracom. *Id.* The '679 Patent claims priority to November 3, 2014 and November 14, 2014. *Id.* It issued on March 13, 2018. *Id.*

1571. The '679 Patent generally relates to 802.11ax MU transmissions, and more specifically to 802.11ax UL acknowledgments transmitted in response to DL MU transmissions: the DL MU transmission indicates whether the UL acknowledgment will be either a single-user (SU) or multi-user (MU) acknowledgment. '679 at 2:11-23.

1572. Annotated Figures 21 and 22 illustrate a preferred embodiment. In that embodiment, the AP transmits a DL MU PPDU to each of STAs 1-4. That DL MU PPDU includes a QoS Control field with ACK Policy subfields. *See* '679 at 34:56-59. Figure 21 shows that when the ACK Policy subfield for STAs 1-3 is set to "Implicit Block ACK Request," each of those STAs 1-3 will simultaneously transmit a UL MU Block ACK PPDU acknowledgment frame in multi-user format (colored blue in the below figure) one SIFS after receiving the DL MU PPDU. *Id.* at 37:3-13. While Figure 22 shows that when the ACK Policy for STAs 1-3 is set to "Block ACK" and the ACK Policy for STA 4 is set

[redacted]

to "Implicit Block ACK Request," then STA 4 will transmit a UL SU Block ACK PPDU acknowledgment frame in single-user format (colored green in the below figure) one SIFS after receiving the DL MU PPDU. *Id.* at 37:36-46. Thus, "the PPDU type of an immediate response to a DL MU PPDU (*i.e.*, a UL response transmitted a predetermined IFS (*e.g.*, an SIFS) after reception of a DL MU PPDU) may be of the UL SU transmission type (*e.g.*, a legacy PPDU type) or the UL MU transmission type (*e.g.*, a UL MU PPDU type), and the type of the immediate response to the DL MU PPDU may be determined based on information (*e.g.*, information triggering UL transmission) included in the DL MU PPDU." *Id.* at 37:59-67.



'679 Figs. 21-22 (annotations and highlighting added).

1573. The aforementioned procedure "improve[s] the performance of a procedure for performing DL MU transmission and transmitting an ACK in response to the DL MU transmission" so that "the use efficiency of a wireless channel may be increased." '679 at 35:43-50.

1574. The '679 Patent has two independent claims, claims 1 and 6. Method claim 1 is drafted from the perspective of the 802.11 station, while method claim 6 is drafted from

[redacted]

the perspective of the 802.11 access point. I have reproduced these two independent claims below, using the same annotations as Dr. Hansen:

1[pre]. A method for transmitting an acknowledgement frame for notifying successful data reception by a station (STA) to an access point (AP) in a wireless local area network, the method comprising:

[**1a**] receiving, from the AP, a downlink frame including a quality of service (QoS) control field including acknowledgement information representing whether the STA is requested to transmit the acknowledgement frame in a single-user (SU) format or in a multiple-user (MU) format at a Short Inter-Frame Space (SIFS) time after the downlink frame; and

[**1b**] transmitting, to the AP, the acknowledgement frame based on the acknowledgement information at the SIFS time after the downlink frame,

[**1c**] wherein transmitting the acknowledgment frame comprises: when the acknowledgment information represents that the STA is requested to transmit the acknowledgement frame in the MU format and the STA is allocated a resource, transmitting the acknowledgement frame in the MU format on the allocated resource simultaneously with transmission of at least one acknowledgement frame from at least one other STA, and

[**1d**] [wherein transmitting the acknowledgment frame comprises:] when the acknowledgment information represents that the STA is requested to transmit the acknowledgement frame in the SU format, transmitting the acknowledgement frame in SU format.

6[pre]. A method for receiving an acknowledgement frame for notifying successful data reception by an access point (AP) from a station (STA) in a wireless local area network, the method comprising:

[**6a**] transmitting, to the STA, a downlink frame including a quality of service (QoS) control field including acknowledgement information representing whether the STA is requested to transmit the acknowledgement frame in a single-user (SU) format or in a multiple-user (MU) format at a Short Inter-Frame Space (SIFS) time after the downlink frame; and

[redacted]

[**6b**] receiving, from the STA, the acknowledgement frame based on the acknowledgement information at the SIFS time after the downlink frame,

[**6c**] wherein receiving the acknowledgment frame comprises: when the acknowledgment information represents that the STA is requested to transmit the acknowledgement frame in the MU format, receiving the acknowledgement frame in the MU format on an allocated resource simultaneously with transmission of at least one acknowledgement frame from at least one other STA, and

[**6d**] [wherein receiving the acknowledgment frame comprises:] when the acknowledgment information represents that the STA is requested to transmit the acknowledgement frame in the SU format, receiving the acknowledgement frame in SU format.

1575. Dr. Hansen provides a summary of the asserted claims of the '679 Patent, which I generally agree with. Hansen Report at ¶139. However, I disagree with his conclusion that "methods for transmitting and receiving acknowledgment frames in the claimed manner were previously known in the art." *Id.*

13.2 '679 Prosecution History

1576. On November 3, 2015, the Applicant filed the '679 application with 20 initial claims. ATLAS-00014778-859.

1577. On March 21, 2017, the Examiner rejected the pending claims as obvious in view of Cheong (US 2013/0188627) and Kang (US 2015/00085836). ATLAS-00014483.

1578. On June 16, 2017, the Applicant and the Examiner had a telephonic interview to discuss the pending claims and the outstanding rejection, as well as a proposed claim amendment. ATLAS-00018768.

1579. On June 21, 0217, the Applicant amended the claims as follows:

[redacted]

1. (Currently Amended) A method for transmitting an ~~uplink~~ acknowledgement frame for notifying successful data reception by a station (STA) to an access point (AP) in a wireless local area network, the method comprising:

receiving, from the AP, a downlink frame including a quality of service (QoS) control field including acknowledgement information representing whether the STA is requested to transmit the acknowledgement frame ~~related to a type of the uplink frame, the type of the uplink frame including~~ in a single-user (SU) ~~type~~ format or [[and]] in a multiple-user (MU) [[type]] format at a Short Inter-Frame Space (SIFS) time after the downlink frame; and

transmitting, to the AP, the acknowledgement ~~uplink~~ frame ~~having a type determined~~ based on the acknowledgement information at the SIFS time after the downlink frame ~~related to the type of the uplink frame~~,

wherein transmitting the acknowledgment frame comprises:[[,]]

when ~~the type of the uplink frame corresponds to the MU type~~ the acknowledgment information represents that the STA is requested to transmit the acknowledgement frame in the MU format and the STA is allocated a resource, transmitting the ~~uplink~~ acknowledgement frame in the MU format [[is]]on the allocated resource simultaneously with transmission of at least one acknowledgement frame from ~~transmitted by a plurality of STAs including the STA and~~ at least one other STA; and

when the acknowledgment information represents that the STA is requested to transmit the acknowledgement frame in the SU format, transmitting the acknowledgement frame in SU format.

ATLAS-00018762 (highlighting added); *see also* ATLAS-00018763-4 (re claim 11). The Applicant argued that the prior art did not disclose or suggest all the features of the claims, emphasizing the highlighted claim language above. ATLAS-00018758. Henceforth, on October 31, 2017, the Examiner allowed the claims. ATLAS-00018770-4. The ’679 Patent issued on March 13, 2018.

1580. Dr. Hansen provides a summary of the ‘679 prosecution history, which I mostly agree with. Hansen Report at ¶140.

[redacted]

13.3 '679 Priority Date

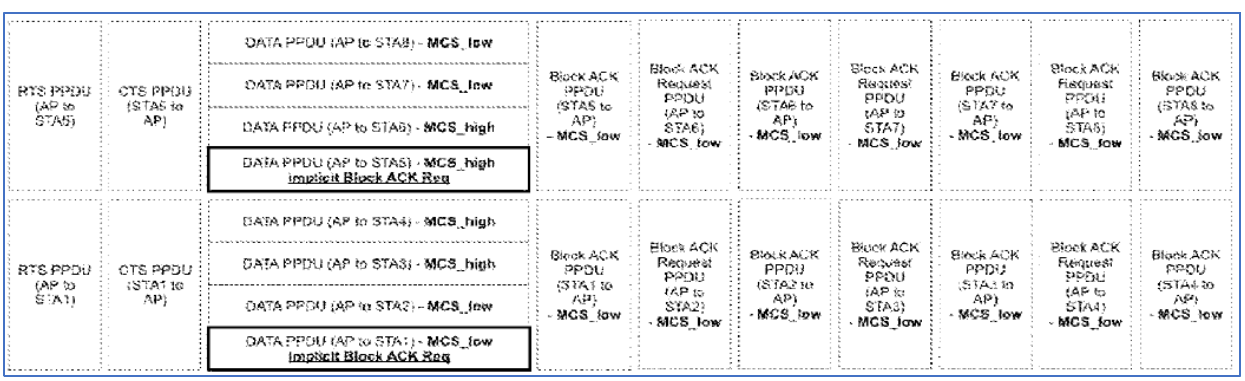
1581. The '679 Patent claims priority to provisional application no. 62/074,514 filed on Nov. 3, 2014 (the "First '679 Provisional") and provisional application no 62/080,026 filed on Nov. 14, 2014 (the "Second '679 Provisional"):

> **Related U.S. Application Data**
>
> (60) Provisional application No. 62/080,026, filed on Nov. 14, 2014, provisional application No. 62/074,514, filed on Nov. 3, 2014.

ATLAS-00014731.

13.3.1 The First '679 Provisional

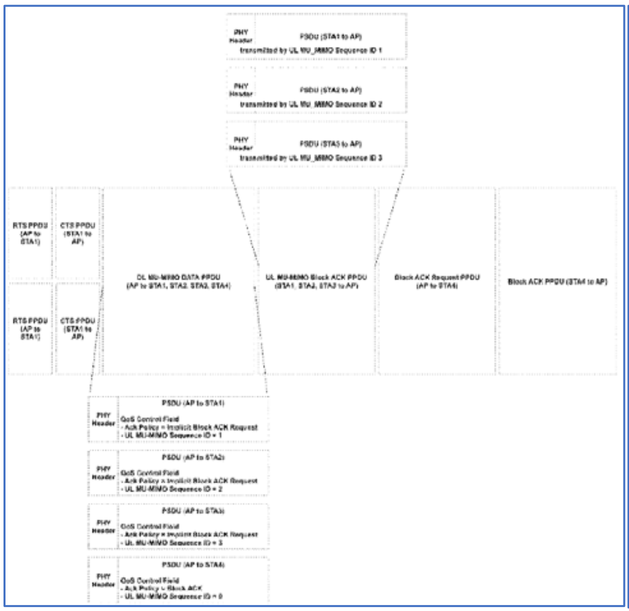
1582. The First '679 Provisional (ATLAS-00018813-51) is titled "HEW PPDU Protection Mechanism." ATLAS-00018815. It "relates to an 802.11ax High Efficiency WLAN (HEW) PPDU transmission [] supporting Orthogonal Frequency Division Multiple Access (OFDMA) technology." ATLAS-00018815. Importantly, it teaches an acknowledgment procedure where "[u]pon receipt of an OFDMA DATA PPDU, STAs perform [a] Block ACK mechanism." ATLAS-00018821. More specifically, as shown in the figure below, it discloses an embodiment where an AP transmits a first DL MU PPDU to STAs 1-4 and a second DL MU PPDU to STAs 5-8. Id. Those DL MU PPDUs indicate that STA1 and STA5 will use an "Implicit Block ACK Req" acknowledgment policy. Accordingly, "STA1 and STA 5 [will] receive the OFDMA PPDU and transmit Block ACK PPDUs after an SIFS in response to the OFDMA PPDU." ATLAS-00018822.

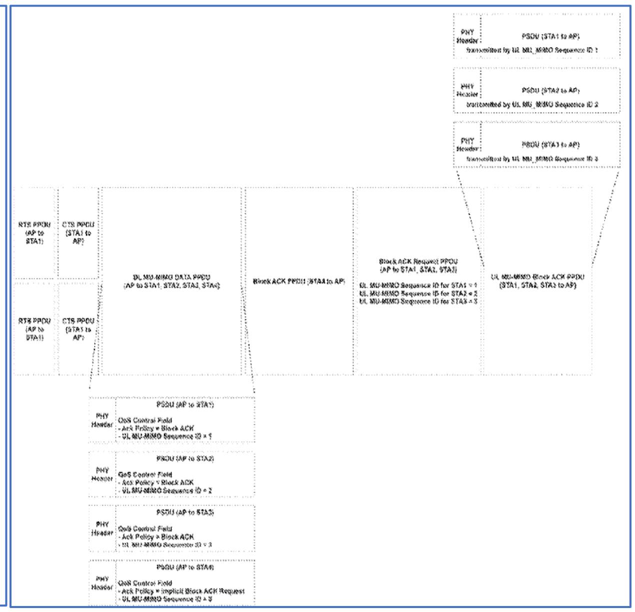


[redacted]

13.3.2 The Second '679 Provisional

1583. The Second '679 Provisional (ATLAS-00018852-905) is titled "Enhanced Downlink MU-MIMO Procedure." ATLAS-00018854. It discloses many embodiments, but the disclosures regarding "the uplink MU-MIMO-based Block ACK PPDU reception procedure for downlink MU-MIMO transmission" is most relevant. ATLAS-00018866; *see also* ATLAS-00018866-9. That embodiment includes two figures reproduced below (which are identical to '679 Figures 21-22 above).





ATLAS-00018867, -69. With respect to the leftmost figure, the Second '679 Provisional teaches "the AP may set the Ack Policy to Implicit Block ACK Request for one or more of Uplink MU-MIMO Supported STAs among the destination STAs of the downlink MU-MIMO transmission. In this case, the one or more STAs reply to the AP with uplink MU-MIMO Block ACK frames an SIFS after receiving the downlink MU-MIMO PPDU." ATLAS-00018867. But with respect to the rightmost figure, the Second '679 Provisional teaches "the AP sets the Ack Policy of a PSDU directed to STA4 being an Uplink MU-MIMO Non-supported STA to Implicit Block ACK Request [and] the Ack Policies of PSDUs directed to the Uplink MU-MIMO Supported STAs, STA1, STA2, and STA3 may not be set to Implicit Block ACK Request and thus are set to Block ACK. The destination

[redacted]

STA of a PSDU with an Ack Policy set to Implicit Block ACK Request, STA4 transmits a Block ACK frame an SIFS after receiving a corresponding downlink MU-MIMO PPDU." ATLAS-00018869.

1584. Based at least on the foregoing citations and figures, it is my opinion that the '679 claims are likely supported by the First '679 Provisional and are definitely supported by the Second '679 Provisional.

1585. Dr. Hansen provides an analysis of the '679 priority claims at paragraphs 56-57 of his report. I agree with Dr. Hansen that the '679 claimed inventions were "constructively reduce[d] to practice by filing U.S. Provisional Application No. 62/074,514 on November 3, 2014 [the First '679 Provisional] [and] U.S. Provisional Application No. 62/080,026 [the Second '679 Provisional] on November 14, 2014." Hansen Report at ¶56.

13.4 Claim Construction

1586. The Court issued a claim construction order on February 8, 2023 ("Claim Construction Order" or "Markman Order"). Dkt. No. 117. I have applied the constructions therein. For terms the court did not construe, I have applied the plane and ordinary meaning to a person of ordinary skill in the art at the time of invention.

1587. With respect to the '679 Patent, the Court construed the following terms:

Term or phrase	Court's Construction
"Single-user (SU) format" / "SU format" (claims 1, 6)	Plain meaning
"multiple user (MU) format" / "MU format" (claims 1, 6)	Plain meaning

Dkt. 117 at 48. According to the Court, "Defendants argue that 'format' is unclear, particularly when considering that the patentee amended during prosecution to replace 'type' with 'format.'" *Id.* at 45. However, the Court explained that "Plaintiff's expert persuasively opines that the specification refers to various relevant 802.11 standards, such as 802.11a, 802.11g, 802.11n, and 802.11ac, and that frame 'format' has been a well-

[redacted]

understood term in those standards." *Id.* at 47. In adopting the plain meaning of these terms, the Court "expressly reject[ed] Defendants' indefiniteness argument." *Id.* at 48.

13.5 Overview of Dr. Hansen's Alleged '679 Prior Art

1588. Dr. Hansen analyzes five references in connection with the '679 Patent: (1) U.S. Patent Pub. No. 2015/0124690 to Simone Merlin et al. ("Merlin '690", Hansen Ex. 679-2); (2) "Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications Amendment 4: Enhancements for Very High Throughput for Operation in Bands below 6 GHz" ("802.11ac-2013", Hansen Ex. 679-3); (3) U.S. Patent Pub. No. 2013/301569 to Xiaofei Wang et al. ("Wang", Hansen Ex. 679-4); (4) Chinese Patent Pub. No. 102769899 ("Zhu", Hansen Ex. 679-5) and specifically the computerized English translation of Zhu by Google ("Zhu Google Translation", Hansen Ex. 679-6); and (5) U.S. Patent No. 8,472,383 to Raja Banerjea et al. ("Banerjea", Hansen Ex. 679-7). Hansen Report at ¶¶2991-3397. I provide an overview of each below.

13.5.1 Merlin '690

1589. Merlin '690 is titled "Method and Apparatus for Transmitting Response Frame Based on Type in a High Efficiency Wireless LAN." Merlin '690 at Title Page. Merlin '690 generally relates to the "frame structures and protocols for uplink multiple user (MU) frame exchanges." Merlin '690 at [0003]. It explains that an AP may send a DL MU frame that solicits an immediate response from a plurality of STAs, and those STAs may immediately respond with an UL acknowledgment—either an ACK or a block ACK. *Id.* at [0009]. The AP's DL MU frame may signal "which STAs are solicited for immediate response (*e.g.*, for immediate BAs), which STAs may use existing ACK policy indications, [and] which mode is to be used for the replies (*e.g.*, UL SU-MIMO, UL MU-MIMO, or UL MU OFDMA)." *Id.* at [0125]. Further, Merlin '690 teaches "a response type indication for each STA may be added [to the DL MU PPDU]. For example 1 or 2 bits may indicate which mode of response is to be used (*e.g.*, UL SU-MIMO, UL MU-MIMO, or UL OFDMA)." *Id.* at [0133]. And the "indication may be included in the Quality of Service

[redacted]

(QoS) control field," for example. *Id.* Merlin '690 also discloses various acknowledgment policies, including "normal ACK," "No ACK," and "delayed BA" policies. *Id.* at [0127]-[0128].

13.5.2 802.11ac-2013

1590. 802.11ac-2013 is titled "Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications; Amendment 4: Enhancements for Very High Throughput for Operation in Bands below 6 GHz." 802.11ac-2013 is colloquially referred to as "Wi-Fi 5." 802.11ac-2013 supported limited DL MU operations (*i.e.*, DL MU MIMO), but did not support UL MU operations—either UL MU MIMO or UL OFDMA. Those UL MU operations were not added to the 802.11 standard until 802.11ax or "Wi-Fi 6." Accordingly, 802.11ac-2013 cannot disclose key limitations of the '679 Patent, including a UL acknowledgment frame in the multiple-user format that is transmitted simultaneously with other UL acknowledgement frames.

1591. Figure 9-9a of 802.11ac-2013 discloses an acknowledgment procedure where a single DL frame is transmitted to multiple STAs, but each STA can only respond sequentially with an acknowledgment; multiple STAs cannot respond with acknowledgments simultaneously:

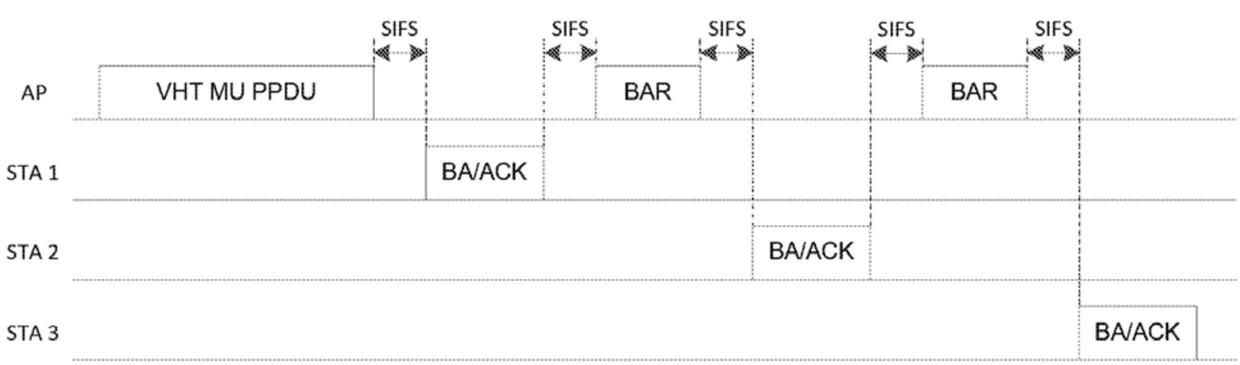


Figure 9-9a—An example of a TXOP containing a VHT MU PPDU transmission with an immediate acknowledgment to the VHT MU PPDU

802.11ac-2013 at TPL0001754.

[redacted]

13.5.3 Wang

1592. Wang is titled "Method and Apparatus for Transmitting Acknowledgments in Response to Received Frames." Wang at Title Page. Wang generally relates to "transmitting acknowledgments in response to data packets" in the context of cellular networks and WLANs. Wang at [0007]. More specifically, Wang discloses a variety of acknowledgment formats, including: a MU-MIMO Block ACK, an Aggregated Multi-User ACK ("A-MU-ACK"), and a single-user piggyback ACK.

1593. Wang Figure 8 illustrates the MU-MIMO BA. As shown, the MU-MIMO BA includes an omni portion 810 that is transmitted for all users and a MU portion that is transmitted via each spatial stream of the MU-MIMO transmission. Wang at [0100]. Wang teaches that, in response to receiving several block ack requests whose BAR ACK policy fields are "0" (indicating non-immediate ACKs), a device may "group several block ACKs [] and transmit them using a MU-MIMO transmission (*i.e.*, delayed MU-MIMO BA)." *Id.* at [0101], [0103]; *see also id.* at Fig. 9.

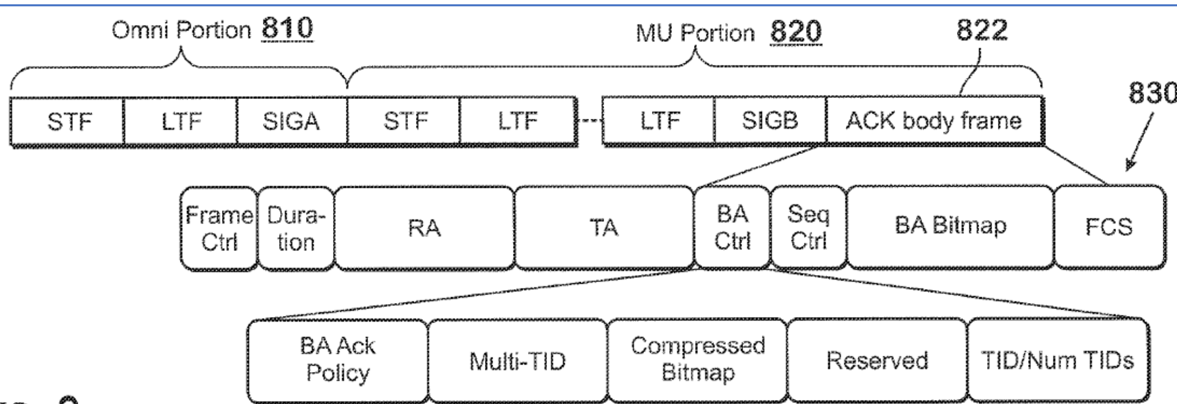


FIG. 8

1594. Wang Figure 11 illustrates the A-MU-ACK. As shown, it comprises a PPDU 1100 with a data portion 1130. Wang at [0108]. That data portion includes an A-MU-ACK frame 1132 with ACKs for multiple users. *Id.* The A-MU-ACK packet may be broadcast to multiple STAs. *Id.* at [0110].

[redacted]

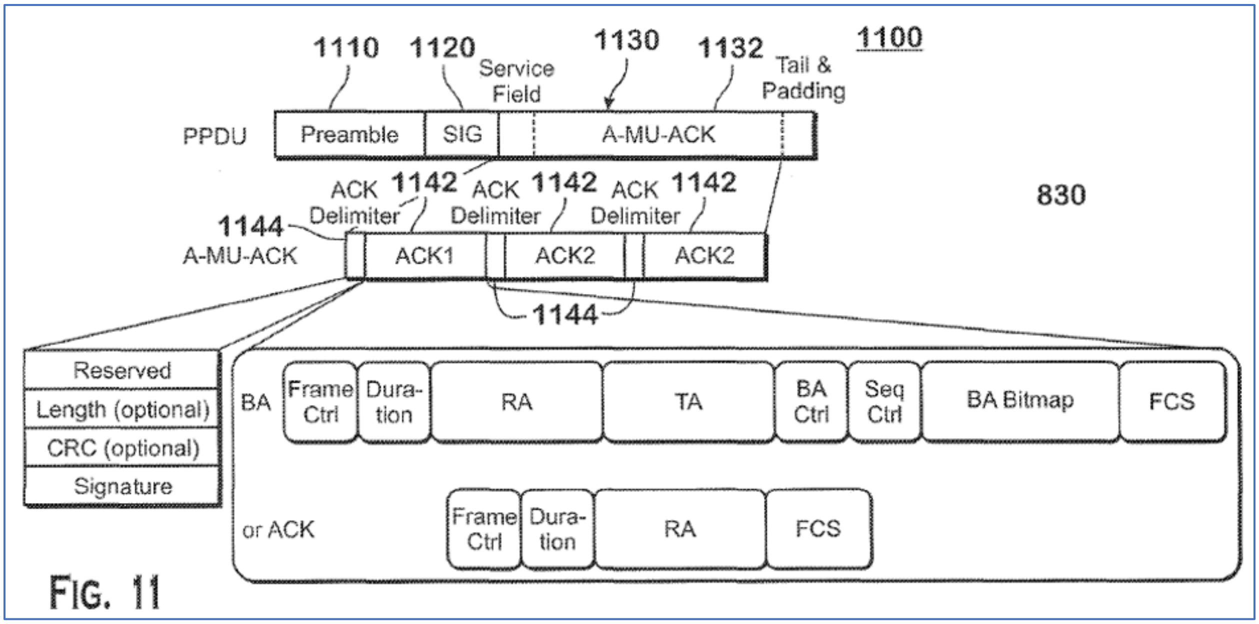


FIG. 11

1595. Finally, Wang Figure 16 illustrates the single user piggyback ACK. Wang at [0120]. When an originator (such as an AP) transmits a frame to a recipient, that frame may indicate that a piggyback ACK is allowed. *Id.* at [0119]. If the recipient has data to send to the originator, the recipient may piggyback the ACK with that data and transmit it as a single frame. *Id.* In this Figure 16 example, the recipient has aggregated the data 1620 with the ACK 1610, and the MAC header 1630 indicates that the frame is a data frame with a piggybacked ACK. *Id.* at [0120].

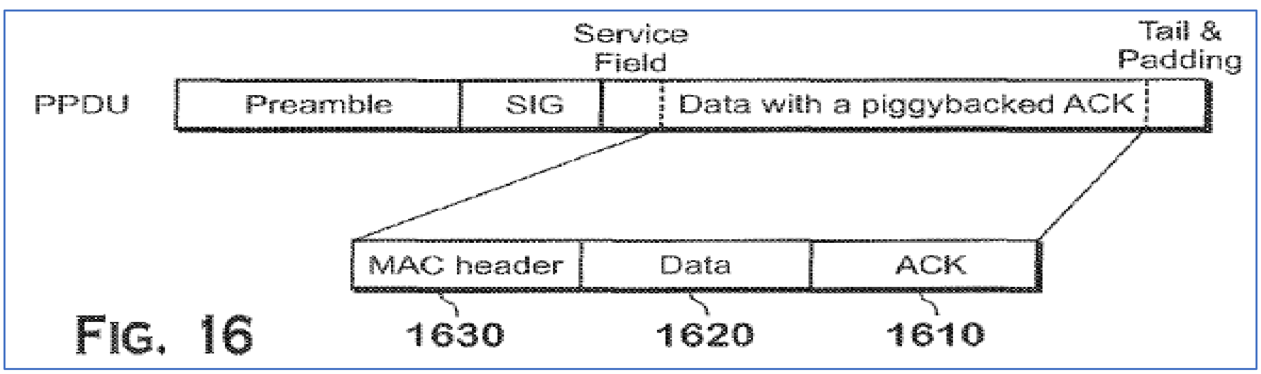


FIG. 16

1596. In sum, Wang does not disclose a STA that receives a downlink frame from an AP that indicates whether the subsequent acknowledgment will be transmitted using SU or MU format, as claimed. It appears that Dr. Hansen asserts Wang's MU-MIMO BA and/or A-MU-ACK correspond to the claimed "multi-user MU format," while Wang's single-user

[redacted]

piggyback ACK corresponds to the claimed "single user SU format." *See* Hansen Report at ¶¶3092-3095, 3120-3122. But Wang never discloses a single downlink frame with any "acknowledgment information" instructing the recipient STA to select between those three ACK types.

1597. Wang Fig. 9 also shows various acknowledgments:

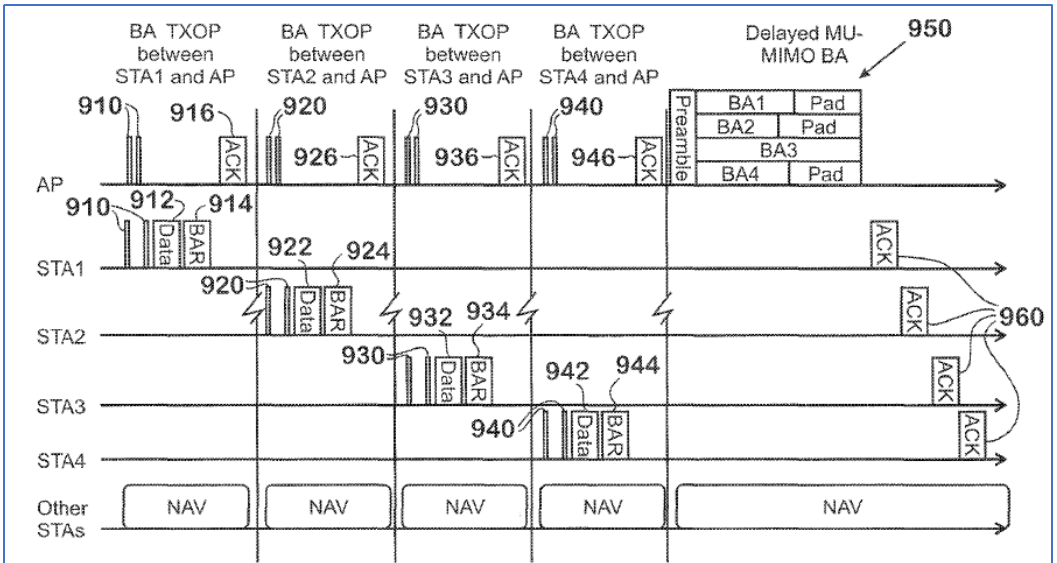


FIG. 9

But that figure shows the AP sending ACKs 916, 926, 936, 946 and 950—not the STAs sending an ACK—like the '679 Patent. Further, there is no teaching that any of BARs 914, 924, 934, or 044 include any information about the type of ACK (*e.g.*, SU vs MU) that must be sent—like the '679 Patent.

13.5.4 Zhu

1598. Zhu appears to be Chinese patent publication 102769899A. Hansen Ex. 679-5. However, it is written entirely in Chinese, and I do not speak Chinese. Dr. Hansen never cites to the Chinese version of Zhu, but rather cites to Google's computerized, non-certified English translation of Zhu. Hansen Report at p. 1038, fn. 1 (citing https://patents.google.com/patent/CN102769899A/en?oq=102769899, Hansen Ex. 679-6). I find it improper to cite to a Google computerized translation of Zhu; Google translations

[redacted]

are not accurate. *E.g.*, https://www.pactranz.com/google-translate-accuracy-issues/; https://lptranslations.com/learn/how-accurate-is-google-translate/. And upon reading the Google computerized translation of Zhu, I find it mostly incoherent "techno-babble." This is likely due to the faulty translation procedure. Nonetheless, the following summarizes Google's computerized translation of Zhu.

1599. Zhu is titled "Method for Sending Data and Wireless Transmission Equipment." TPL0020644. Zhu generally relates to "STA equipment that send data under the power saving mode." TPL0020645 (Zhu at [0002]). According to Zhu, current "power saving method[s] do[] not have the STA [] get into sleep state in the current TXOP." *Id.* Zhu proposes a method that permits a "dormant STA device [to] shutdown [it]self, thereby reduc[ing] power consumption." *Id.* Zhu's "Summary of the Invention" is as follows:

> The embodiment of the invention provides a kind of method of data transmission, is used to improve the fairness of channel competition, in a transmission opportunity TXOP, comprises:
>
> Send the candidate control frame to candidate terminal equipment STA, comprise association identification and the MAC Address of said candidate STA in the said candidate control frame;
>
> Send Frame to key player on a team STA; Also comprise in the said Frame and allow to get into the sleep state sign; Wherein said key player on a team STA is the corresponding target STA of this TXOP, and said key player on a team STA can get into sleep state according to said sleep state sign after key player on a team STA sends the Frame completion;
>
> After said key player on a team STA sends Frame and accomplishes, according to the association identification of said candidate STA and MAC Address to said candidate STA transmission Frame.

TPL0020646 (Zhu at [0008]-[0011]). As can be seen from the above, Zhu has little if anything to do with the '679 Patent. It does not relate to acknowledgments at all—much less an AP transmitting a DL frame indicating whether the STA(s) UL acknowledgment will be in single-user or multiple-user format, like the '679 Patent.

[redacted]

13.5.5 Banerjea

1600. Banerjea is titled "Group Management in Multiuser Communications." Banerjea at Title Page. Banerjea relates to 802.11ac (Wi-Fi 5) technology where an AP can group two or more STAs with similar estimated transmission power levels so that the STAs in the selected group can simultaneously transmit data to the AP without having to adjust their respective power levels. *See id.* at 3:12-19, 4:44-5:11. By excluding STAs having dissimilar power levels, Banerjea reduces interference. *Id.*

1601. Figure 3A best illustrates Banerjea's teachings. *First*, the AP sends an assignment frame 108 that tells the STAs what group they are in (based on similar estimated power transmission levels calculated using channel feedback reports). Banerjea at 6:22-45. In this example, STA1 and STA2 are grouped together. *Second*, the AP sends an Uplink Assignment Indicator ("USI") 110 that indicates when the stations in the group can simultaneously transmit data to the AP; in this example, one SIFS after the USI is received. *Id.* at 6:46-56. *Finally*, the STAs in the group simultaneously transmit UL MU data frames according to the USI. *Id.*

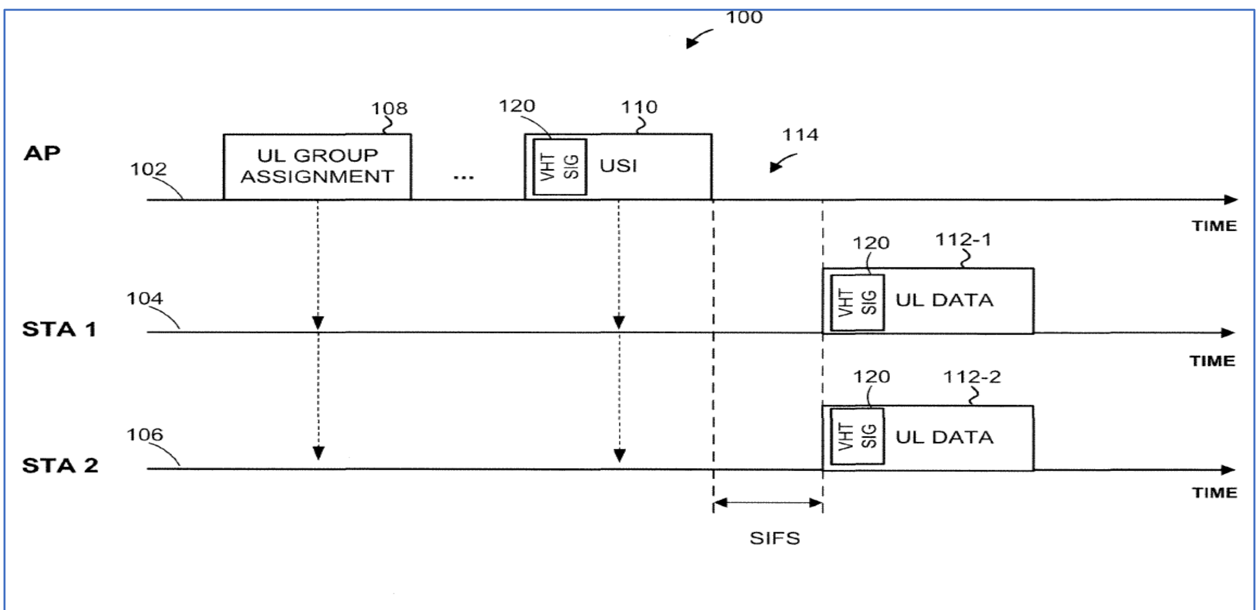


FIG. 3A

[redacted]

1602. Importantly, nothing in Banerjea relates to an AP notifying a STA whether it will transmit acknowledgments using single-user or multi-user format, as per the '679 Patent. Banerjea does not disclose any acknowledgment mechanisms—much less whether acknowledgments will be in single-user or multi-user format, as per the '679 claims.

13.6 Dr. Hansen's Alleged '679 Prior Art Does Not Invalidate the Asserted '679 Claims

1603. Dr. Hansen states that each of the following references anticipate the Asserted '679 claims: Merlin '690, 802.11ac-2013, Wang, Zhu, and Banerjea. Hansen Report at ¶2991. Dr. Hansen also states that those same references render the Asserted '679 claims obvious, either by themselves or in any combination of those five references. *Id.* I disagree.

13.6.1 Merlin '690 Fails To Disclose Or Render Obvious Several '679 Claim Limitations

13.6.1.1 Merlin '690 Fails to Teach or Suggest a "Downlink Frame Including a QoS Control Field Including Acknowledgment Information representing Whether the STA Is Requested to Transmit the Acknowledgment Frame in a Single-User Format Or In A Multiple-User Format At A Short Inter-Frame Space (SIFS) Time After the Downlink Frame" (1A, 6A)

1604. Each of the '679 claims require a "downlink frame including a quality of service (QoS) control field including acknowledgement information representing whether the STA is requested to transmit the acknowledgement frame in a single-user (SU) format or in a multiple-user (MU) format at a Short Inter-Frame Space (SIFS) time after the downlink frame." '679 at 41:41-47 ('679 cl. 1); 42:24-30 ('679 cl. 6).

1605. Dr. Hansen cites evidence that he asserts proves Merlin '690 discloses these limitations. Hansen Report at ¶¶3015-3022 (1[a]), ¶¶3288-3289 (6[a]). But Merlin '690 does not teach or suggest these limitations, as described below.

1606. Dr. Hansen cites various passages from Merlin '690 that characterize its DL MU frame as soliciting an "immediate response" acknowledgment. *E.g.*, Hansen Report at ¶3015 (citing Merlin '690 at [0128]) ("the MPDU soliciting the **immediate response** may

[redacted]

be set to '**<u>immediate response</u>**.'") (emphasis added); *id.* (citing Merlin '690 at [0125] ("Such signaling may include which STAs should [be] solicited for **<u>immediate response</u>**") (emphasis added). However, none of the Merlin '690 passages cited by Dr. Hansen teach the solicited "acknowledgment frame" is to be transmitted "at a Short Inter-Frame Space (SIFS) time after the downlink frame," as claimed. Merlin '690's "immediate response" is not the same as the claimed "SIFS time."

1607. The '679 Patent uses Figures 21 and 22 to show an example of how the claimed downlink frame uses acknowledgment information in a QoS control field to represent whether the STA should transmit in SU or MU format "at a SIFS time after the downlink frame." For example, the '679 Patent explains that if the ACK Policy in the QoS control field is set to Implicit Block ACK Request for STAs 1-3 and the ACK Policy in the QoS control field is not set to Implicit Block Ack Request for STA 4, then STAs 1-3 will simultaneously transmit an UL MU Block ACK PPDU a SIFS after receiving the DL frame:

> In the example of FIG. 21, the ACK Policy is set to Implicit Block ACK Request for STA1, STA2, and STA3 supporting UL MU transmission (i.e., supporting the UL MU transmission-based response type) in a DL MU DATA PPDU. In this case, **<u>STA1, STA2, and STA3 may transmit a UL MU Block ACK PPDU to the AP a predetermined IFS (e.g., an SIFS) after receiving the DL MU DATA PPDU</u>**. That is, the UL MU transmission supported STAs (i.e., STAs supporting the UL MU transmission-based response type), STA1, STA2, and STA3 may simultaneously transmit block ACK frames in UL MU transmission. Since different channel estimation sequences (e.g., HE-STF and HE-LTF sequences) are used for the plurality of STAs participating in the UL MU transmission, the AP may receive the block ACK frames from the plurality of STAs without collision.

'679 at 37:3-35 (emphasis added). Conversely, the '679 Patent explains that if the ACK Policy in the QoS control field is set to Block ACK for STAs 1-3 and the ACK Policy in the QoS control field is set to Implicit Block Ack Request for STA 4, then STA 4 will transmit an UL SU block ACK PPDU a SIFS after receiving the DL frame:

[redacted]

> Meanwhile, in the example of FIG. 22, the ACK Policy is set to Block ACK for STA1, STA2, and STA3 supporting UL MU transmission (i.e., supporting the UL MU transmission-based response type) and to Implicit Block ACK Request for STA4 that does not support UL MU transmission (i.e., supporting only the UL SU transmission-based response type) in a DL MU DATA PPDU. In this case, **STA4 may transmit a block ACK PPDU (e.g., a legacy block ACK PPDU or a UL SU block ACK PPDU) a predetermined IFS (e.g., an SIFS) after receiving the DL MU DATA PPDU from the AP**.

'679 at 37:36-57 (emphasis added).

1608. Merlin '690 never has a commensurate disclosure as the '679 Patent. Merlin '690's teachings regarding an "immediate response" is not the same as the '679 claimed "Short Inter-Frame Space (SIFS) time after the downlink frame."

1609. Dr. Hansen does cite one paragraph from Merlin '690 that uses the term "SIFS" with respect to Fig. 4:

> Upon receiving the RTS message 402, the selected STA (e.g., STA1) may transmit a Clear to Send (CTS) message 404 to the AP. **The RTS message 402 and the CTS message 404 may be separated by a short inter-frame space (SIFS), a small interval between a data frame or other message and its acknowledgment (ACK)**. In response to receiving the CTS message 404, the AP may send DL-MU-MIMO data 406 to STAs selected by the scheduler (typically part of the processing system of the AP, such as scheduler 234 in FIG. 2). The STAs receiving the MU-MIMO data 406 may transmit BAs 408 in the uplink (UL) in series, starting with the BA for STA1 and ending with the BA for STA3 as shown in FIG. 4. **The STA BA transmissions may be separated by SIFS**. The order and timing for the STA BA transmissions may be sent in the DL-MU-MIMO data 406.

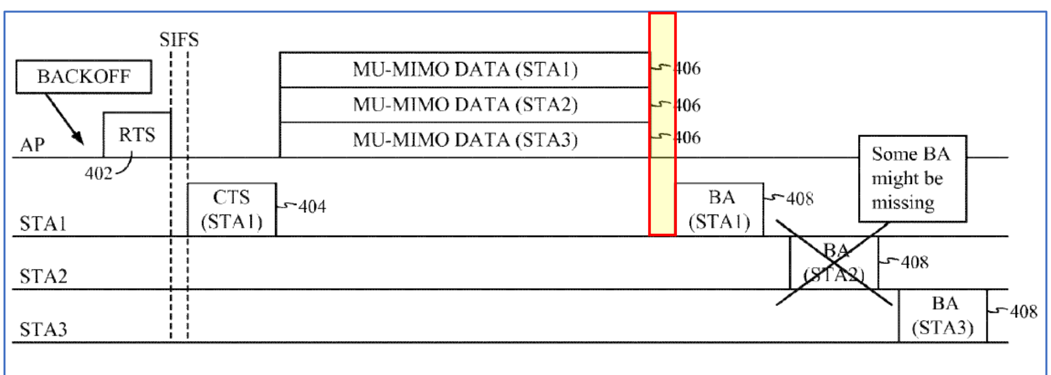


FIG. 4

Hansen Report at ¶3021 (citing Merlin '690 at [0115], Fig. 4) (emphasis added). However, that disclosure of the term "SIFS" by Merlin '690 is very different than the '679 claims.

[redacted]

As shown above, Merlin '679 teaches to separate the RTS and CTS by a SIFS, and also to separate the STA BA transmissions by a SIFS. But Merlin '679 never teaches to separate the DL frame 406 from the BA 408 by a SIFS (highlighted yellow in Fig. 4 above).

1610. Dr. Hansen cites various passages from Merlin '690 that characterize its DL MU frame as indicating which "mode of response" is to be used for the replies. *E.g.*, Hansen Report at ¶3017 (citing Merlin '690 at [0133]) ("a response type indication for each STA may be added in each MPDU or PSDU. For example, 1 or 2 bits may indicate which **mode of response is to be used (e.g., UL SU-MIMO, UL MU-MIMO or UL FDMA)**") (emphasis added); *id.* at ¶3015 (citing Merlin '690 at [0125]) (the DL frame signaling "may include … **which mode is to be used for the replies (e.g., UL SU-MIMO, UL MU-MIMO, or UL MU FDMA**") (emphasis added). However, none of the Merlin '690 passages cited by Dr. Hansen teach the acknowledgment information in the DL frame "represent[s] whether the STA is requested to transmit the acknowledgment frame in a single-user (SU) format or in a multiple-user (MU) format," as claimed. Merlin '690's "mode of response" does not clearly and convincingly indicate a "SU format" or "MU format," as claimed.

1611. The '679 Patent teaches "the present invention relates to a Wireless Local Area Network (WLAN)"—in other words 802.11 "Wi-Fi" WLANs. '679 at 1:18-23. And the '679 specification distinguishes between so called "legacy 802.11" WLANs (*i.e.*, those specified in prior "legacy" standards like 802.11 a/b/g/n/ac) and current WLANs specified in the new 802.11ax standard. *See* '679 at 14:33-36 (disclosing "legacy" standards) and 10:18-23 (disclosing "a new PPDU frame format for the IEEE 802.11ax HEW system."). Importantly, the prior legacy 802.11 standards only provided for single-user uplink transmissions, while 802.11ax was the first standard to introduce multi-user uplink transmissions. Those new 802.11ax multi-user uplink transmissions could not use the "single user format" from the legacy standards, but rather required a new "multi-user format."

[redacted]

1612. The '679 Patent also discloses a "legacy block ACK PPDU" in Figure 22 and a "UL MU block ACK PPDU" in Figure 21. *Id.* at Figs. 21-22, 37:3-57. The legacy block ACK PPDU is amply described in legacy 802.11 standards, for example 802.11ac:

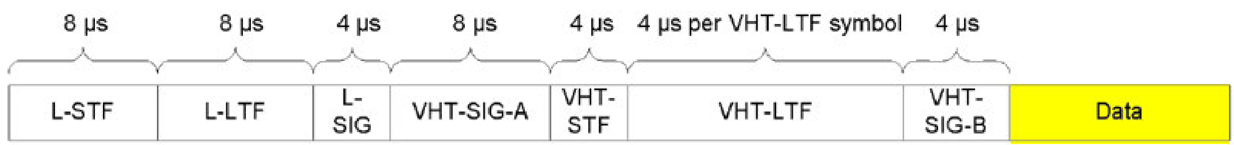
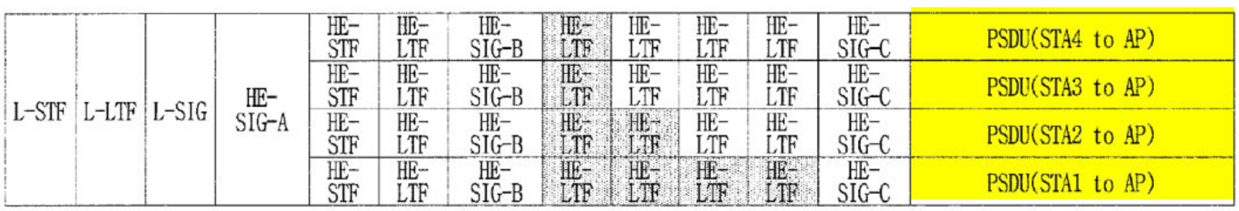


Figure 22-4—VHT PPDU format

802.11ac at ATLAS-00032173 (highlighting added). This is an example of the claimed "single-user format." While the UL MU block ACK PPDU is shown at '679 Fig. 13:

FIG. 13



'679 at Fig. 13 (highlighting added). This is an example of the claimed "multiple user format."

1613. Importantly, Merlin '690 never explicitly teaches any such "single-user format" or "multi-user format"—certainly not at any of the passages cited by Dr. Hansen. Hansen Report at ¶¶3015-3021. A naked reference to "UL SU-MIMO, UL MU-MIMO or UL FDMA" does not clearly and convincingly teach or suggest the claimed "single-user format" or "multi-user format" of the PPDU used to transmit in either of these "modes."

1614. For these reasons, it is my opinion that Merlin '690 does not teach or suggest these claim limitations.

[redacted]

13.6.1.2 Merlin '690 Fails to Teach or Suggest Transmitting Or Receiving an "Acknowledgement Frame Based On The Acknowledgement Information At The SIFS Time After The Downlink Frame" (1B, 6B)

1615. Each of the '679 claims require either transmitting or receiving "the acknowledgement frame based on the acknowledgement information at the SIFS time after the downlink frame." '679 at 41:48-50 ('679 cl. 1); 42:31-33 ('679 cl. 6).

1616. Dr. Hansen cites evidence that he asserts proves Merlin '690 discloses these limitations. Hansen Report at ¶¶3054-3506 (1[b]), ¶¶3300-3301 (6[b]). But Merlin '690 does not teach or suggest these limitations.

1617. Dr. Hansen's primary evidence for this limitation is as follows:

> In response to receiving the CTS message 404, the AP may send DL-MU-MIMO data 406 to STAs selected by the scheduler (typically part of the processing system of the AP, such as scheduler 234 in FIG. 2). The STAs receiving the MU-MIMO data 406 may transmit **<u>BAs 408 in the uplink (UL) in series, starting with the BA for STA1 and ending with the BA for STA3 as shown in FIG. 4. The STA BA transmissions may be separated by SIFS</u>**.

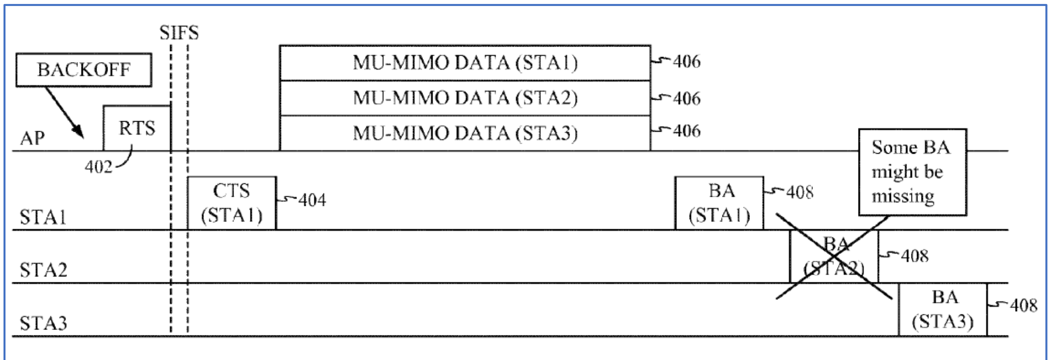


FIG. 4

Hansen Report at ¶3054 (citing Merlin '690 at [0115], Fig. 4) (emphasis added). Thus, Dr. Hansen presumably maps Merlin '690's Block Acks 408 to the '679 claimed "acknowledgment frame." But Merlin '690 never teaches that those Block Acks 408 use the SU and/or MU format disclosed in the '679 Patent and as claimed. *See* my analysis for '679 1[a] above. Nor does Merlin '690 ever teach that those Block Acks 408 are transmitted "at the SIFS time after the downlink frame," as claimed. Instead, Merlin '690

[redacted]

only teaches that the Block Acks 408 themselves should be separated from one another by a SIFS. Merlin '690 at [0115].

1618. Dr. Hansen also cites another passage from Merlin '690, which teaches:

> According to certain aspects, the AP may receive an MU packet from each of the plurality of devices including **a plurality of A-MPDUs, each A-MPDU having an ACK associated with the MU packet**. The AP may process the received MU packets to confirm that the MU packet sent by the AP was successfully received at each device.

Hansen Report at ¶3055 (citing Merlin '690 at [0185]) (emphasis added). Thus, Dr. Hansen may also presumably map Merlin '690's A-MPDU to the '679 claimed "acknowledgment frame." But Merlin '690 never teaches that the A-MPDUs use the SU and/or MU format disclosed and claimed in the '679 Patent. Nor does Merlin '690 ever teach that the A-MPDU is transmitted "at the SIFS time after the downlink frame," as claimed.

1619. For these reasons, it is my opinion that Merlin '690 does not teach or suggest these claim limitations.

13.6.1.3 Merlin '690 Fails to Teach or Suggest Transmitting Or Receiving "the Acknowledgement Frame in the MU Format On The Allocated Resource Simultaneously With Transmission of At Least One Acknowledgement Frame From At Least One Other STA" "When The Acknowledgment Information Represents that the STA Is Requested To Transmit the Acknowledgement Frame in the MU Format and The STA is Allocated a Resource" (1C, 6C)

1620. Each of the '679 claims require either transmitting or receiving "the acknowledgement frame in the MU format on the allocated resource simultaneously with transmission of at least one acknowledgement frame from at least one other STA" "when the acknowledgment information represents that the STA is requested to transmit the acknowledgement frame in the MU format and the STA is allocated a resource." '679 at 41:51-60 ('679 cl. 1); 42:34-41 ('679 cl. 6).

[redacted]

1621. Dr. Hansen cites evidence that he asserts proves Merlin '690 discloses these limitations. Hansen Report at ¶¶3083-3086 (1[c]), ¶¶3312-3313 (6[c]). But Merlin '690 does not teach or suggest these limitations.

1622. As discussed above, Merlin '690 does not disclose the claimed "acknowledgement information" or the claimed "multiple-user format." *See supra.* Accordingly, Merlin '690 cannot disclose transmitting/receiving an acknowledgment frame in the non-existent "multiple-user format" based on the non-existent "acknowledgment information."

1623. For these reasons, it is my opinion that Merlin '690 does not teach or suggest these claim limitations.

13.6.1.4 Merlin '690 Fails to Teach or Suggest Transmitting Or Receiving "the Acknowledgement Frame in the SU Format" "When The Acknowledgment Information Represents that the STA is Requested To Transmit the Acknowledgement Frame in the SU Format" (1D, 6D)

1624. Each of the '679 claims require either transmitting or receiving "the acknowledgement frame in the SU format" "when the acknowledgment information represents that the STA is requested to transmit the acknowledgement frame in the SU format." '679 at 41:61-42:2 ('679 cl. 1); 42:42-45 ('679 cl. 6).

1625. Dr. Hansen cites evidence that he asserts proves Merlin '690 discloses these limitations. Hansen Report at ¶¶3113-3116 (1[d]), ¶¶3324-3325 (6[d]). But Merlin '690 does not teach or suggest these limitations.

1626. As discussed above, Merlin '690 does not explicitly disclose the claimed "acknowledgement information" or the claimed "single-user format." *See supra.* Accordingly, Merlin '690 cannot disclose transmitting/receiving an acknowledgment frame in the non-existent "single-user format" based on the non-existent "acknowledgment information."

1627. For these reasons, it is my opinion that Merlin '690 does not teach or suggest these claim limitations.

[redacted]

13.6.1.5 Merlin '690 Fails to Teach or Suggest that "A Same MCS Based on the MCS Information is Applied to the Acknowledgement Frame by the STA and The at Least One Other STA" (3, 8)

1628. Dependent claims 3 and 8 of the '679 Patent require that "a same MCS based on the MCS information is applied to the acknowledgement frame by the STA and the at least one other STA." '679 at 42:7-10 ('679 cl. 3); 42:50-53 ('679 cl. 8).

1629. Dr. Hansen cites evidence that he asserts proves Merlin '690 discloses these limitations. Hansen Report at ¶¶3171-3173 (3), ¶¶3348-3349 (8). But Merlin '690 does not teach or suggest these limitations.

1630. While Dr. Hansen cites several passages from Merlin '690, only one passage even mentions "MCS":

> Option 1: According to certain aspects, a first option to indicate response parameters may be to extend existing rules for the immediate response bandwidth (BW) and modulation and coding schemes (MCSs)…. According to certain aspects, **<u>the MCS may be derived as a function of the request MCS and may also account for the bandwidth</u>**. According to certain aspects, the mapping may be defined by the wireless standards or may be indicated by the AP.

Hansen Report at ¶3140 (citing Merlin '690 at [0140]) (emphasis added). As can be seen, that passage merely explains that the MCS of the UL response "may be **<u>derived</u>** as a function of the request MCS" from the DL frame. *Id.* (emphasis added). Nowhere in that passage does Merlin '690 teach the downlink frame actually explicitly "includes MCS information" for any UL acknowledgment frame—much less that two STAs use the same MCS for their UL acknowledgment frames.

1631. For these reasons, it is my opinion that Merlin '690 does not teach or suggest these claim limitations.

[redacted]

13.6.2 802.11ac-2013 Fails To Disclose Or Render Obvious Several '679 Claim Limitations

13.6.2.1 802.11ac-2013 Fails to Teach or Suggest a "Downlink Frame Including a QoS Control Field Including Acknowledgment Information representing Whether the STA Is Requested to Transmit the Acknowledgment Frame in a Single-User Format Or In A Multiple-User Format At A Short Inter-Frame Space (SIFS) Time After the Downlink Frame" (1A, 6A)

1632. Each of the '679 claims require a "downlink frame including a quality of service (QoS) control field including acknowledgement information representing whether the STA is requested to transmit the acknowledgement frame in a single-user (SU) format or in a multiple-user (MU) format at a Short Inter-Frame Space (SIFS) time after the downlink frame." '679 at 41:41-47 ('679 cl. 1); 42:24-30 ('679 cl. 6).

1633. Dr. Hansen cites evidence that he asserts proves 802.11ac-2013 discloses these limitations. Hansen Report at ¶¶3023-3029 (1[a]), ¶¶3290-3291 (6[a]). But 802.11ac-2013 does not teach or suggest these limitations, as described below.

1634. Dr. Hansen relies heavily on Figure 9-9a as proof that 802.11ac-2013 discloses these claim limitations:

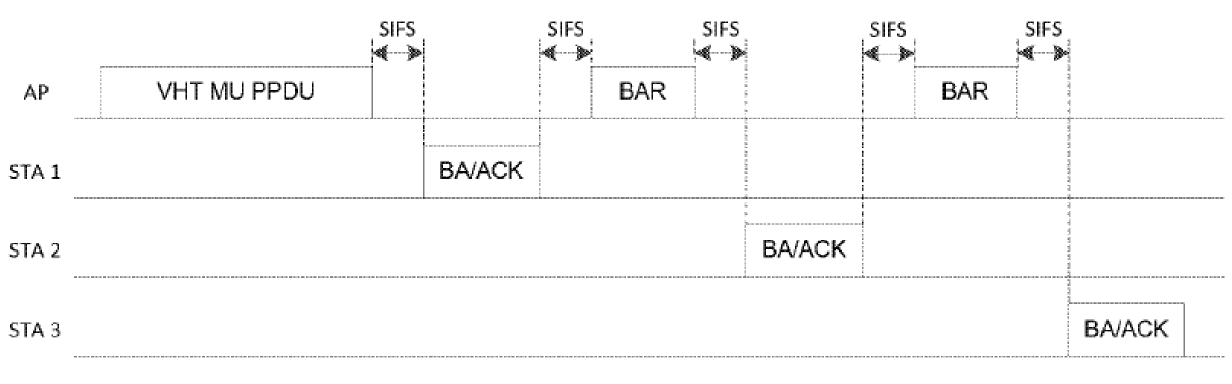


Figure 9-9a—An example of a TXOP containing a VHT MU PPDU transmission with an immediate acknowledgment to the VHT MU PPDU

Hansen Report at ¶3026 (citing 802.11ac-2013 at TPL-0001754). Dr. Hansen also notes that the VHT MU PPDU transmitted from the AP (top left in Figure 9-9a) may include a

[redacted]

QoS Control field with an Ack Policy subfield that includes "Normal Ack" and "Implicit Block Ack Request" ack policies:

Table 8-6—Ack Policy subfield in QoS Control field of QoS data frames

Bits in QoS Control field		Meaning
Bit 5	Bit 6	
0	0	Normal Ack or Implicit Block Ack Request. In a frame that is a non-A-MPDU frame or VHT single MPDU: The addressed recipient returns an ACK or QoS +CF-Ack frame after a short interframe space (SIFS) period, according to the procedures defined in 9.3.2.8 and 9.19.3.5. For a non-DMG STA, this is the only permissible value for the Ack Policy subfield for individually addressed QoS Null (no data) frames. ~~In a frame that is part of an A-MPDU~~Otherwise: The addressed recipient returns a BlockAck MPDU, either individually or as part of an A-MPDU starting a SIFS after the PPDU carrying the frame, according to the procedures defined in 9.3.2.9, 9.21.7.5, 9.21.8.3, 9.25.3, 9.25.4, and 9.29.3.

Hansen Report at ¶3027 (citing 802.11ac-2013 at TPL0001665). However, unlike 802.11ax, that 802.11ac-2013 Ack Policy subfield does not include a "HETP Ack" policy that permits an acknowledgment frame in "MU format." *Id.* As shown in Figure 9-9a, 802.11ac-2013 only provides for a sequential acknowledgment by one STA at a time. Accordingly, 802.11ac-2013 cannot teach or suggest the claimed "acknowledgement information representing whether the STA is requested to transmit the acknowledgement frame [] in a multiple-user (MU) format at a Short Inter-Frame Space (SIFS) time after the downlink frame."

1635. Dr. Hansen cites this passage from 802.11ac-2013 as supposedly disclosing the claimed "MU format":

22.3.4.10 Construction of the Data field in a VHT MU PPDU

22.3.4.10.1 General

For an MU transmission, the PPDU encoding process is performed on a per-user basis up to the input of the Spatial Mapping block except CSD (as described in 22.3.8.3.2). All user data is combined and mapped to the transmit chains in the Spatial Mapping block.

[redacted]

Hansen Report at ¶3025 (citing 802.11ac-2013 at TPL0001874). However, such VHT MU PPDUs are only used for DL transmissions; 802.11ac-2013 does not support VHT MU PPDUs for UL transmissions, including UL acknowledgments. Accordingly, it is irrelevant as to the '679 claimed "acknowledgment frames" transmitted "in a MU format."

1636. For these reasons, it is my opinion that 802.1ac-2013 does not teach or suggest these claim limitations.

13.6.2.2 802.11ac-2013 Fails to Teach or Suggest Transmitting Or Receiving an "Acknowledgement Frame Based On The Acknowledgement Information At The SIFS Time After The Downlink Frame" (1B, 6B)

1637. Each of the '679 claims require either transmitting or receiving "the acknowledgement frame based on the acknowledgement information at the SIFS time after the downlink frame." '679 at 41:48-50 ('679 cl. 1); 42:31-33 ('679 cl. 6).

1638. Dr. Hansen cites evidence that he asserts proves 802.11ac-2013 discloses these limitations. Hansen Report at ¶¶3057-3061 (1[b]), ¶¶3302-3303 (6[b]). But 802.11ac-2013 does not teach or suggest these limitations. As discussed above, 802.11ac-2013 does not disclose the claimed "acknowledgement information" that can represent whether to transmit an acknowledgment frame in "multiple-user format." *See supra.* Accordingly, 802.11ac-2013 cannot disclose transmitting/receiving an acknowledgment frame based on the non-existent "acknowledgment information."

1639. For these reasons, it is my opinion that 802.11ac-2013 does not teach or suggest these claim limitations.

[redacted]

13.6.2.3 802.11ac-2013 Fails to Teach or Suggest Transmitting Or Receiving "the Acknowledgement Frame in the MU Format On The Allocated Resource Simultaneously With Transmission of At Least One Acknowledgement Frame From At Least One Other STA" "When The Acknowledgment Information Represents that the STA Is Requested To Transmit the Acknowledgement Frame in the MU Format and The STA is Allocated a Resource" (1C, 6C)

1640. Each of the '679 claims require either transmitting or receiving "the acknowledgement frame in the MU format on the allocated resource simultaneously with transmission of at least one acknowledgement frame from at least one other STA" "when the acknowledgment information represents that the STA is requested to transmit the acknowledgement frame in the MU format and the STA is allocated a resource." '679 at 41:51-60 ('679 cl. 1); 42:34-41 ('679 cl. 6).

1641. Dr. Hansen cites evidence that he asserts proves 802.11ac-2013 discloses these limitations. Hansen Report at ¶¶3087-3091 (1[c]), ¶¶3314-3315 (6[c]). But 802.11ac-2013 does not teach or suggest these limitations.

1642. As discussed above, 802.11ac-2013 does not disclose the claimed "acknowledgement information" or the claimed "multiple-user format." *See supra.* Accordingly, 802.11ac-2013 cannot disclose transmitting/receiving an acknowledgment frame in the non-existent "multiple-user format" based on the non-existent "acknowledgment information."

1643. For these reasons, it is my opinion that 802.11ac-2013 does not teach or suggest these claim limitations.

13.6.2.4 802.11ac-2013 Fails to Teach or Suggest Transmitting Or Receiving "the Acknowledgement Frame in the SU Format" "When The Acknowledgment Information Represents that the STA is Requested To Transmit the Acknowledgement Frame in the SU Format" (1D, 6D)

1644. Each of the '679 claims require either transmitting or receiving "the acknowledgement frame in the SU format" "when the acknowledgment information

[redacted]

represents that the STA is requested to transmit the acknowledgement frame in the SU format." '679 at 41:61-42:2 ('679 cl. 1); 42:42-45 ('679 cl. 6).

1645. Dr. Hansen cites evidence that he asserts proves 802.11ac-2013 discloses these limitations. Hansen Report at ¶¶3117-3319 (1[d]), ¶¶3326-3327 (6[d]). But 802.11ac-2013 does not teach or suggest these limitations.

1646. As discussed above, 802.11ac-2013 does not disclose the claimed "acknowledgement information." *See supra.* Accordingly, 802.11ac-2013 cannot disclose transmitting/receiving an acknowledgment frame in the "single-user format" based on the non-existent "acknowledgment information."

1647. For these reasons, it is my opinion that 802.11ac-2013 does not teach or suggest these claim limitations.

13.6.2.5 802.11ac-2013 Fails to Teach or Suggest that the "Downlink Frame Further Includes Modulation and Coding Scheme (MCS) Information for the Acknowledgement Frame" (2, 7)

1648. Dependent claims 2 and 7 of the '679 Patent require that the "downlink frame further includes Modulation and Coding Scheme (MCS) information for the acknowledgement frame." '679 at 42:3-6 ('679 cl. 2); 42:46-49 ('679 cl. 7).

1649. Dr. Hansen cites evidence that he asserts proves 802.11ac-2013 discloses these limitations. Hansen Report at ¶¶3143-3147 (2), ¶¶3338-3339 (7). But 802.11ac-2013 does not teach or suggest these limitations.

1650. Dr. Hansen cites several passages from 802.11ac-2013 that use the term "MCS," but none of them are relevant. First, Dr. Hansen cites this passage, which relates to "mesh STAs":

[redacted]

9.7.4 Basic Rate Set and Basic MCS Set for mesh STA

Change the last two paragraphs of 9.7.4 as follows:

Mesh STAs should adopt the mandatory PHY rates as the default BSSBasicRateSet to reduce the risk that a candidate peer mesh STA utilizes a different BSSBasicRateSet. If the mesh STA is also an HT STA, it should adopt the ~~MCSs of~~ mandatory HT MCSs as the default BSSBasicMCSSet. If the mesh STA is also a VHT STA, it should adopt <VHT-MCS, NSS> tuples formed from the mandatory VHT-MCSs and NSS = 1 as the default BSS basic VHT-MCS and NSS set (see 10.39.7).

Once the mesh STA establishes a mesh peering with a mesh STA, it shall not change ~~neither~~ the BSSBasicRateSet, ~~nor the~~ BSSBasicMCSSet, or BSS basic VHT-MCS and NSS set.

Hansen Report at ¶3143 (citing 802.11ac-2013 at TPL0001756). But that passage does not even mention any "downlink frame"—much less that it has "MCS Information for the Acknowledgment frame," as claimed. Instead, that passage relates to obtaining MCS information from a "default BSSBasicMCSSet." *Id.*

1651. Second, Dr. Hansen cites these passages from 802.11ac-2013:

Change the fourth paragraph of 9.7.6.4 as follows:

A frame that is carried in an HT PPDU shall be transmitted by the STA using an MCS supported by the receiver STA, as reported in the Supported MCS Set field in the HT Capabilities element ~~in management frames transmitted by~~ received from that STA. When the supported ~~rate~~ MCS set of the receiving STA or STAs is not known, the transmitting STA shall transmit using an MCS in the BSSBasicMCSSet parameter.

Change 9.7.6.5.3 as follows:

If a control response frame is to be transmitted within an HT or VHT PPDU, the channel width (CH_BANDWIDTH parameter of the TXVECTOR) shall be selected first according to 9.7.6.6, and then the MCS or <VHT-MCS, NSS> tuple shall be selected from a set of MCSs and <VHT-MCS, NSS> tuples called the *CandidateMCSSet* as described in this subclause.

If a control response frame is to be transmitted within an HT or VHT PPDU, the channel width (CH_BANDWIDTH parameter of the TXVECTOR) shall be selected first according to 9.7.6.6, and then the MCS or <VHT-MCS, NSS> tuple shall be selected from a set of MCSs and <VHT-MCS, NSS> tuples called the *CandidateMCSSet* as described in this subclause.

Hansen Report at ¶3144 (citing 802.11ac-2013 at TPL0001759, 61). But those passages teach to obtain the MCS information from a "HT Capabilities element" and the "CandidateMCSSet." *Id.* They do not teach that the "downlink frame" has MSC information, as claimed.

[redacted]

1652. Third, Dr. Hansen cites this passage from 802.11ac-2013:

> At a minimum, a VHT STA sets the Rx MCS Bitmask of the Supported MCS Set field of its HT Capabilities element according to the setting of the Rx VHT-MCS Map subfield of the Supported VHT-MCS and NSS Set field of its VHT Capabilities element as follows: for each subfield Max VHT-MCS For n SS, $1 \le n \le 4$, of the Rx VHT-MCS Map field with a value other than 3 (no support for that number of spatial streams), the STA shall indicate support for MCSs $8(n-1)$ to $8(n-1)+7$ in the Rx MCS Bitmask, where n is the number of spatial streams, except for those MCSs marked as unsupported as described in 9.7.11.3.

Hansen Report at ¶3145 (citing 802.11ac-2013 at TPL0001817). But once again, that passage teaches to obtain the MCS information from a "HT Capabilities element"—not from the "downlink frame," as claimed.

1653. Finally, Dr. Hansen generally cites the TXVECTOR and RXVECTOR parameters from Table 22-1 of 802.11ac-2013:

Table 22-1—TXVECTOR and RXVECTOR parameters *(continued)*

Parameter	Condition	Value	TXVECTOR	RXVECTOR

* * * * *

MCS	FORMAT is VHT	Indicates the modulation and coding scheme used in the transmission of the PPDU. Integer: range 0 to 9	MU	Y
	Otherwise	See corresponding entry in Table 20-1		

Hansen Report at ¶3146 (citing 802.11ac-2013 at TPL0001851-5). While there is a "MCS" TXVECTOR and RXVECTOR, that only "indicates the modulating and coding scheme used in the transmission of the PPDU." *Id.* Nothing in Table 22-1 teaches or suggests that the "downlink frame" includes MCS information for the acknowledgement frame, as claimed.

1654. For these reasons, it is my opinion that 802.11ac-2013 does not teach or suggest these claim limitations.

[redacted]

13.6.2.6 802.11ac-2013 Fails to Teach or Suggest that "A Same MCS Based on the MCS Information is Applied to the Acknowledgement Frame by the STA and The at Least One Other STA" (3, 8)

1655. Dependent claims 3 and 8 of the '679 Patent require that "a same MCS based on the MCS information is applied to the acknowledgement frame by the STA and the at least one other STA." '679 at 42:7-10 ('679 cl. 3); 42:50-53 ('679 cl. 8).

1656. Dr. Hansen cites evidence that he asserts proves 802.11ac-2013 discloses these limitations. Hansen Report at ¶¶3174-3178 (3), ¶¶3350-3351 (8). But 802.11ac-2013 does not teach or suggest these limitations.

1657. Dr. Hansen cites the same four 802.11ac-2013 passages for these limitations as he did for claims 2 and 7. As discussed above, none of those passages teach or suggest the "downlink frame" (as opposed to, *e.g.*, the HT Capabilities element) includes the MCS information for the acknowledgment frame. Certainly nothing in those same 802.11ac-2013 passages teaches or suggests that multiple STAs would have the same MCS. Indeed, that is impossible, considering that 802.11ac-2013 does not support UL MU operation; that was not provided until 802.11ax.

1658. For these reasons, it is my opinion that 802.11ac-2013 does not teach or suggest these claim limitations.

13.6.2.7 802.11ac-2013 Fails to Teach or Suggest that the "Downlink Frame Includes Block Acknowledgement (ACK) Requests for a Plurality of STAs Including the STA and the At Least One Other STA" (5, 10)

1659. Dependent claims 5 and 10 of the '679 Patent require that "the downlink frame includes block acknowledgement (ACK) requests for a plurality of STAs including the STA and the at least one other STA." '679 at 42:16-19 ('679 cl. 5); 42:58-61 ('679 cl. 10).

1660. Dr. Hansen cites evidence that he asserts proves 802.11ac-2013 discloses these limitations. Hansen Report at ¶¶3242-3250 (5), ¶¶3374-3375 (10). But 802.11ac-2013 does not teach or suggest these limitations.

[redacted]

1661. These figures from 802.11ac-2013 show that the VHT MU PPDU (what Dr. Hansen alleges as the claimed "downlink frame") does not include multiple block acknowledgment requests:

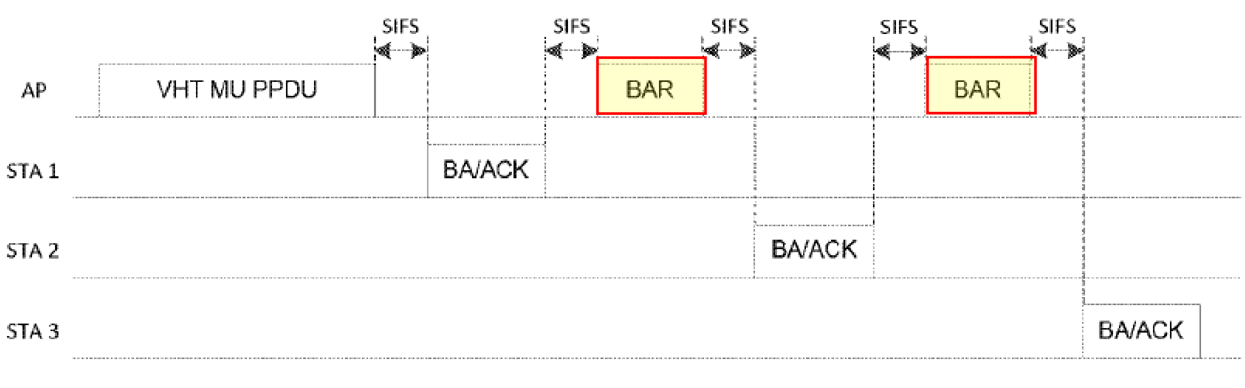


Figure 9-9a—An example of a TXOP containing a VHT MU PPDU transmission with an immediate acknowledgment to the VHT MU PPDU

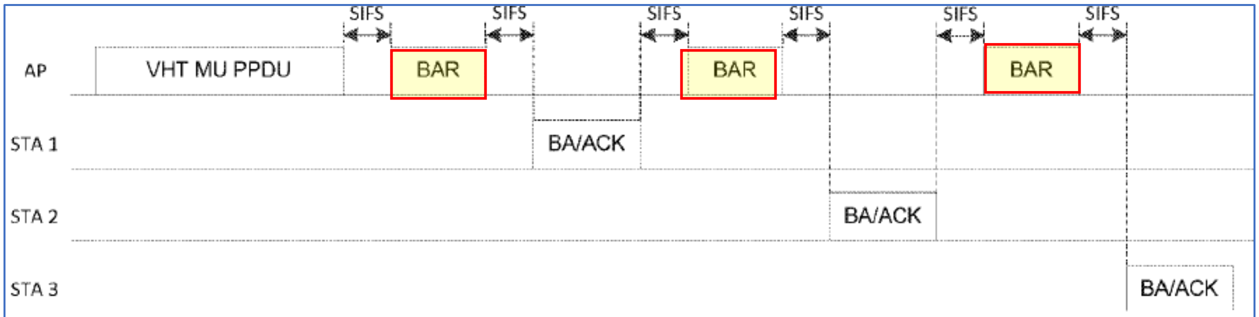


Figure 9-9b—An example of a TXOP containing a VHT MU PPDU transmission with no immediate acknowledgment to the VHT MU PPDU

802.11ac-2013 at TPL0001754 emphasis added). To the contrary, as shown by the yellow annotations, the block ack requests (labeled "BAR") are separate from the VHT MU PPDU. Accordingly, the VHT MU PPDU does not include multiple BARs, as claimed.

1662. For these reasons, it is my opinion that 802.11ac-2013 does not teach or suggest these claim limitations.

[redacted]

13.6.3 Wang Fails To Disclose Or Render Obvious Several '679 Claim Limitations

13.6.3.1 Wang Fails to Teach or Suggest a "Downlink Frame Including a QoS Control Field Including Acknowledgment Information representing Whether the STA Is Requested to Transmit the Acknowledgment Frame in a Single-User Format Or In A Multiple-User Format At A Short Inter-Frame Space (SIFS) Time After the Downlink Frame" (1A, 6A)

1663. Each of the '679 claims require a "downlink frame including a quality of service (QoS) control field including acknowledgement information representing whether the STA is requested to transmit the acknowledgement frame in a single-user (SU) format or in a multiple-user (MU) format at a Short Inter-Frame Space (SIFS) time after the downlink frame." '679 at 41:41-47 ('679 cl. 1); 42:24-30 ('679 cl. 6).

1664. Dr. Hansen cites evidence that he asserts proves Wang discloses these limitations. Hansen Report at ¶¶3030-3036 (1[a]), ¶¶3292-3293 (6[a]). But Wang does not teach or suggest these limitations, as described below.

1665. Dr. Hansen cites this paragraph from Wang, presumably in an attempt to show that Wang discloses the claimed "QoS control field including acknowledgment information representing whether the STA is requested to transmit the acknowledgment frame in a single-user format or in a multiple-user format":

> The selected MCS and bandwidth for the following ACK frame may be indicated in the MAC header of the data packet. **FIG. 7 shows a conventional MAC frame format. In the current 802.11 standards, an ACK policy subfield is defined in a QoS control field 710 of the MAC header. The ACK policy subfield is 2 bits in length and identifies the acknowledgment policy that is followed upon delivery of the MPDU.** In one embodiment, the ACK policy subfield may be extended for MCS and bandwidth indication. The number of bits needed for MCS and bandwidth information may vary depending on the standards.

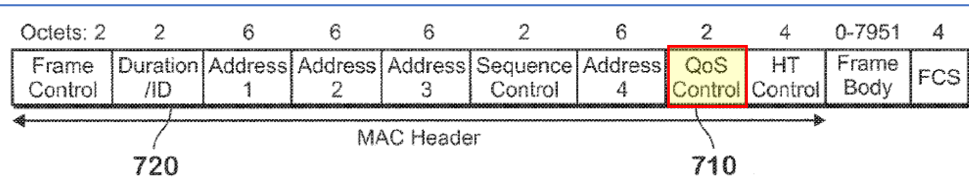


FIG. 7

[redacted]

Hansen Report at ¶3035 (citing Wang at [0094], Fig. 1) (emphasis added). While that passage certainly discloses a QoS control field 710 having a 2-bit ACK Policy subfield, nowhere does Wang teach or suggest that that ACK Policy subfield within the QoS control field 710 indicates whether the subsequent ACK will be either: (1) the acknowledgments transmitted after a Delayed MU-MIMO BA or an A-MU-ACK (what Dr. Hansen presumably alleges to be the claimed "MU format," *see* Hansen Report at ¶¶3092-3095); or (2) a SU Piggyback ACK (what Dr. Hansen presumably alleges to be the claimed "SU format," *see* Hansen Report at ¶¶3120-3122).

1666. Nor does Wang at [0094] and Fig. 7 teach that QoS control field 710 indicates whether the acknowledgment will be transmitted "at a Short Inter-Frame Space (SIFS) time after the downlink frame," as claimed. To the contrary, Wang teaches that the BAR control field 1002 (which is not the QoS control field 710) indicates whether the acknowledgment will be immediate or delayed:

FIG. 10 shows a BAR frame format. **<u>The BAR frame 914 includes a BAR control field 1002.</u>** If a BAR ACK policy field in the BAR control field 1002 is set to '1', the recipient **<u>returns an ACK immediately upon receipt of the BAR frame 914</u>**. If a BAR ACK policy field in the BAR control field 1002 is set to '0', the recipient **<u>does not send an ACK upon receipt of the BAR frame</u>** 914.

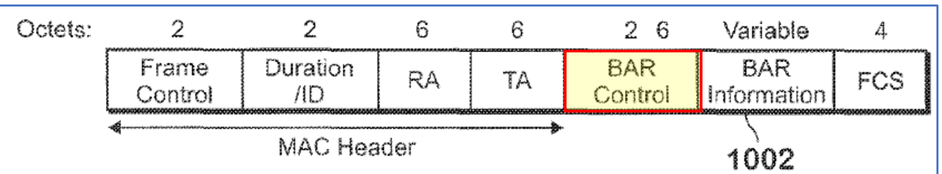


FIG. 10

Wang at [0101], Fig. 10 (emphasis added); *see also id.* at [0119] ("The piggyback ACK may be **<u>immediate or delayed</u>**. If the recipient has no data payload to the originator, the recipient may delay the ACK (*i.e.*, piggyback the ACK with data later).") (emphasis added).

1667. Nor does Wang teach the claimed "multi-user format" and "single-user format," as explained below with respect to '679 claim limitations 1[C]-[D].

[redacted]

1668. For these reasons, it is my opinion that Wang does not teach or suggest these claim limitations.

13.6.3.2 Wang Fails to Teach or Suggest Transmitting Or Receiving an "Acknowledgement Frame Based On The Acknowledgement Information At The SIFS Time After The Downlink Frame" (1B, 6B)

1669. Each of the '679 claims require either transmitting or receiving "the acknowledgement frame based on the acknowledgement information at the SIFS time after the downlink frame." '679 at 41:48-50 ('679 cl. 1); 42:31-33 ('679 cl. 6).

1670. Dr. Hansen cites evidence that he asserts proves Wang discloses these limitations. Hansen Report at ¶¶3062-3065 (1[b]), ¶¶3304-3305 (6[b]). But Wang does not teach or suggest these limitations. As discussed above, Wang does not disclose the claimed "acknowledgement information" that can represent whether to transmit an acknowledgment frame in "multiple-user format" or "single-user format." *See supra.* Accordingly, Wang cannot disclose transmitting/receiving an acknowledgment frame based on the non-existent "acknowledgment information."

1671. Dr. Hansen's analysis for this limitation consists entirely of block copying Wang at [0097]-[0110] and referencing generally Figures 9 and 11, without any analysis or explanation. Hansen Report at ¶¶3062-3065 (1[b]), ¶¶3304-3305 (6[b]). None of those passages or Figures reference any "SIFS." Notwithstanding, it appears Dr. Hansen relies heavily on this passage from Wang:

> The AP may modulate the BAs with different MU-MIMO weights, and transmits them simultaneously. Within the MU-MIMO BA frame, the BA ACK policy field in the BA control field indicates whether an ACK is requested in response to the BA frame. The BA ACK policy field may be set to '0' or '1' for all users. If the BA ACK policy field is set to '1', the BA frame 950 will not solicit an ACK response from the originator (STA1-STA4 in this example). **If the BA ACK policy field is set to '0', the BA frame 950 solicits an ACK response 960 from the originators (STA1-STA4 in this example) as shown in FIG. 9**.

[redacted]

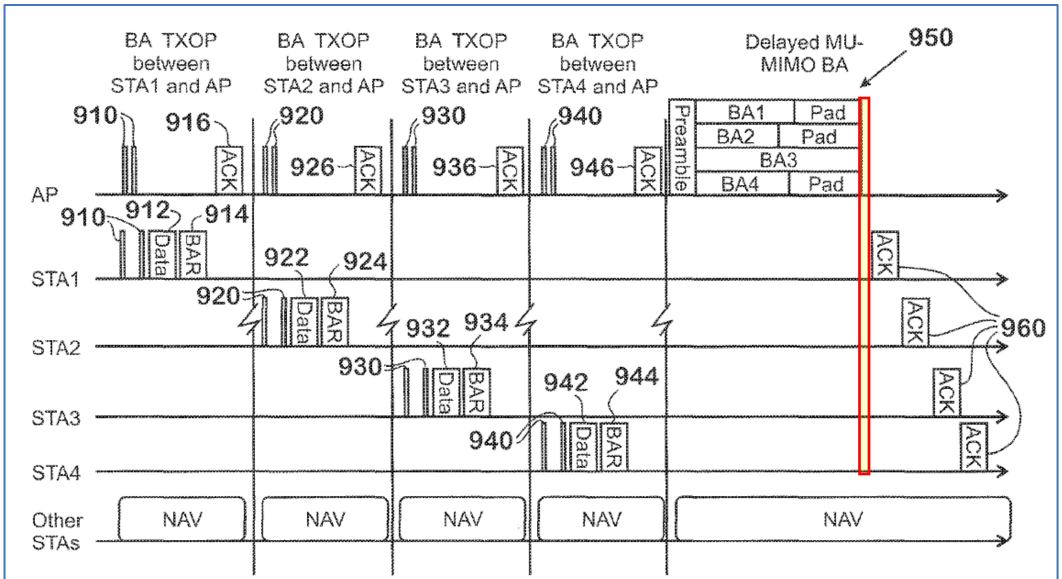


FIG. 9

Wang at [0104], Fig. 9 (emphasis added). Presumably, Dr. Hansen alleges that Wang's delayed MU-MIMO BA 950 maps to the '679 claimed "downlink frame," and that Wang's ACK response 960 maps to the '679 claimed "acknowledgment frame." But nowhere does Wang teach or suggest that ACK response 960 is transmitted "at the SIFS time after" the delayed MU-MIMO BA 950, as required by the '679 claims. Instead, Wang is silent on the length of time that occurs between delayed MU-MIMO BA 950 and ACK response 960 (highlighted in the annotated Fig. 9 above).

1672. For these reasons, it is my opinion that Wang does not teach or suggest these claim limitations.

13.6.3.3 Wang Fails to Teach or Suggest Transmitting Or Receiving "the Acknowledgement Frame in the MU Format On The Allocated Resource Simultaneously With Transmission of At Least One Acknowledgement Frame From At Least One Other STA" "When The Acknowledgment Information Represents that the STA Is Requested To Transmit the Acknowledgement Frame in the MU Format and The STA is Allocated a Resource" (1C, 6C)

1673. Each of the '679 claims require either transmitting or receiving "the acknowledgement frame in the MU format on the allocated resource simultaneously with transmission of at least one acknowledgement frame from at least one other STA"

[redacted]

"when the acknowledgment information represents that the STA is requested to transmit the acknowledgement frame in the MU format and the STA is allocated a resource." '679 at 41:51-60 ('679 cl. 1); 42:34-41 ('679 cl. 6).

1674. Dr. Hansen cites evidence that he asserts proves Wang discloses these limitations. Hansen Report at ¶¶3092-3095 (1[c]), ¶¶3316-3317 (6[c]). But Wang does not teach or suggest these limitations.

1675. As discussed above, Wang does not disclose the claimed "acknowledgement information" that "represents that the STA is requested to transmit the acknowledgment frame" in a certain format. *See supra.* Accordingly, Wang cannot disclose transmitting/receiving an acknowledgment frame in the multiple-user format based on the non-existent "acknowledgment information."

1676. Dr. Hansen's analysis for this limitation consists entirely of block copying Wang at [0097]-[0110] and referencing generally Figures 9 and 11, without any analysis or explanation. Hansen Report at ¶¶3092-3095 (1[b]), ¶¶3316-3317 (6[b]). Notwithstanding the lack of specificity, it appears Dr. Hansen believes the claimed "MU format" that is transmitted simultaneously with acknowledgments from other STAs is either (1) the acknowledgments transmitted after a Delayed MU-MIMO BA (*see* Wang Fig. 9) or (2) an A-MU-ACK (*see* Wang Fig. 11). *Id.* I address each in turn.

1677. First, Dr. Hansen cites this passage, which relates to Wang Fig. 9:

> FIG. 9 shows an example message exchange sequence for delayed MU-MIMO block ACK…. **<u>The ACK responses 960 from the STAs in response to the MU-MIMO BA 950 may be transmitted by the STAs simultaneously using MU-MIMO</u>**. Alternatively, the STAs may transmit an ACK sequentially, for example, according to the user position array defined in a group ID. The group ID may be included in the SIG field.

[redacted]

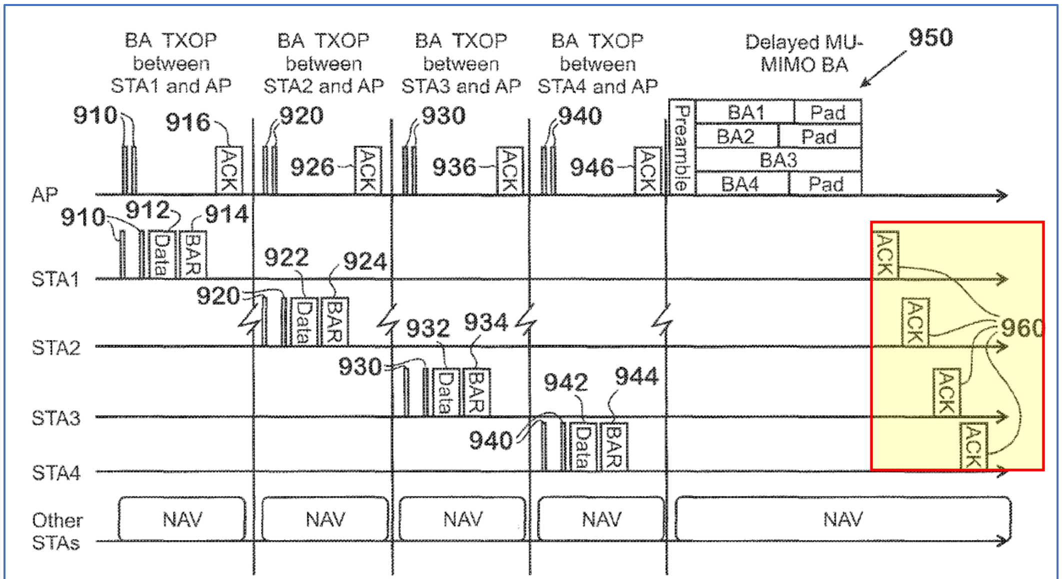


FIG. 9

Hansen Report at ¶3093 (citing Wang at [0101]-[0105], Fig. 9) (emphasis added). But Wang never teaches the "format" of those ACK 960s, as claimed. Nor does Wang disclose that the STAs transmitting those ACK 960s are "allocated a resource," as claimed.

1678. Second, Dr. Hansen cites this passage, which relates to Wang Fig. 11:

> In another embodiment, instead of transmitting ACKs or BAs for multiple users with MU-MIMO, **the ACKs or BAs may be aggregated in time domain and transmitted sequentially**, (i.e., an aggregated multi-user ACK (A-MU-ACK)). A receiver (STA or AP) receives data packets, and generates acknowledgement packets in response to received data packets, and **may aggregate the acknowledgement packets and transmit the aggregated acknowledgement packets in the single transmission**. FIG. 11 shows an example PPDU structure for an A-MU-ACK frame. In FIG. 11, the ACKs are aggregated at the MPDU level. The aggregated ACKs may be block ACKs or normal ACKs. The PPDU for the A-MU-ACK 1100 includes a preamble 1110, an SIG field 1120, and a data field 1130. Within the data field 1130, the A-MU-ACK frame 1132 is included. **The A-MU-ACK frame 1132 includes ACK (or BA) MPDUs 1142 for one or more users (ACK1, ACK2, ACK3 in this example) separated by ACK delimiters 1144.** The ACK/BA MPDUs 1142 are aggregated at a MAC level and the A-MU-ACK frame 1132 is passed to the physical layer as an aggregated MPDU packet so that the A-MU-ACK frame 1132 may be coded and modulated by the physical layer as a whole packet. The lowest MCS may be used for the A-MU-ACK…. **The aggregated multi-user ACK packet may be broadcast or multicast to more than one user (e.g., STA)**.

[redacted]

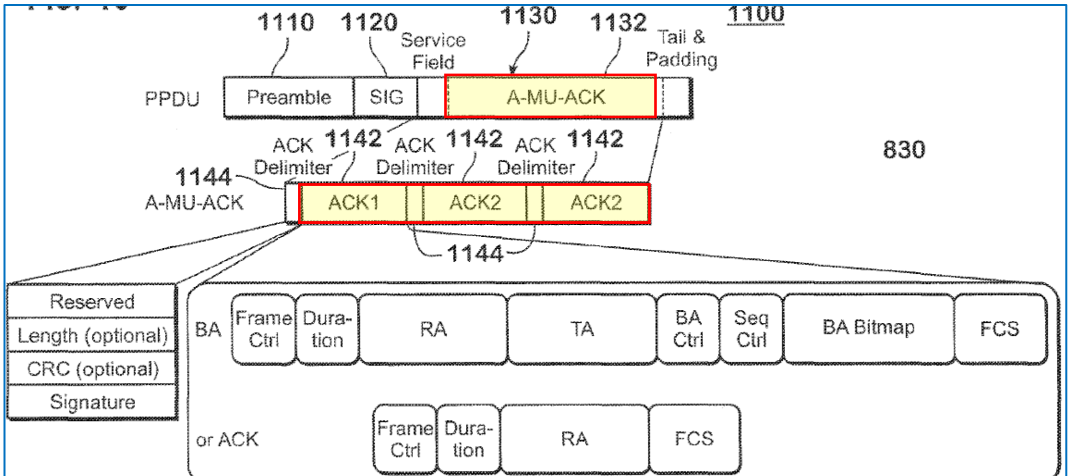


FIG. 11

Hansen Report at ¶3094 (citing Wang at [0107]-[0110], Fig. 11) (emphasis added). But as can shown above, the ACKs in Wang's A-MU-ACK frame 132 are transmitted sequentially; they are not transmitted "simultaneously" with acknowledgments from other STAs, as claimed. Nor does Wang disclose that the STA transmitting the A-MU-ACK frame 132 is "allocated a resource," as claimed.

1679. For these reasons, it is my opinion that Wang does not teach or suggest these claim limitations.

13.6.3.4 Wang Fails to Teach or Suggest Transmitting Or Receiving "the Acknowledgement Frame in the SU Format" "When The Acknowledgment Information Represents that the STA is Requested To Transmit the Acknowledgement Frame in the SU Format" (1D, 6D)

1680. Each of the '679 claims require either transmitting or receiving "the acknowledgement frame in the SU format" "when the acknowledgment information represents that the STA is requested to transmit the acknowledgement frame in the SU format." '679 at 41:61-42:2 ('679 cl. 1); 42:42-45 ('679 cl. 6).

1681. Dr. Hansen cites evidence that he asserts proves Wang discloses these limitations. Hansen Report at ¶¶3120-3122 (1[d]), ¶¶3328-3329 (6[d]). But Wang does not teach or suggest these limitations.

[redacted]

1682. As discussed above, Wang does not disclose the claimed "acknowledgement information." *See supra.* Accordingly, Wang cannot disclose transmitting/receiving an acknowledgment frame in the single-user format based on the non-existent "acknowledgment information."

1683. Dr. Hansen's analysis for this limitation consists entirely of block copying Wang at [0119]-[0125] and referencing generally Figures 15-17, without any analysis or explanation. Hansen Report at ¶¶3120-3122 (1[b]), ¶¶3328-3329 (6[b]). Notwithstanding the lack of specificity, it appears Dr. Hansen believes the claimed "SU format" maps to Wang's single user piggyback ACK. *Id.*

1684. Dr. Hansen relies heavily on this passage, which relates to Wang Fig. 15:

> **The ACK and the data to which the ACK is piggybacked may be directed to a single user, (i.e., single user piggyback ACK). FIG. 15 shows an example of single user piggyback ACK**. An originator transmits a data packet 1510 to a recipient. **If the data is not time sensitive, a piggyback ACK may be used**. The originator may indicate (e.g., in the data packet) that a piggyback ACK is allowed. If the recipient has data payload 1530 directed to the originator, the recipient may piggyback the ACK 1520 with the data packet 1530. **The piggyback ACK may be immediate or delayed**. If the recipient has no data payload to the originator, the recipient may delay the ACK, (i.e., piggyback the ACK with data later).

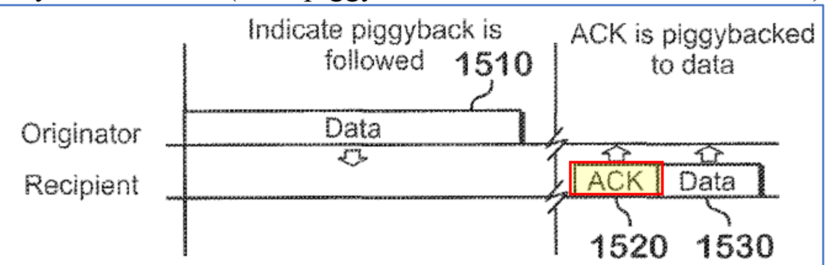


FIG. 15

Hansen Report at ¶3120 (citing Wang at [0119], Fig. 15) (emphasis added). But Wang never discloses the "format" of this SU piggyback ACK 1520.

1685. For these reasons, it is my opinion that Wang does not teach or suggest these claim limitations.

[redacted]

13.6.3.5 Wang Fails to Teach or Suggest that the "Downlink Frame Includes Downlink Data For a Plurality of STAs" (4, 9)

1686. Dependent claims 4 and 90 of the '679 Patent require that "the downlink frame includes downlink data for a plurality of STAs including the STA and the at least one other STA." '679 at 42:11-14 ('679 cl. 4); 42:54-57 ('679 cl. 9).

1687. Dr. Hansen cites evidence that he asserts proves Wang discloses these limitations. Hansen Report at ¶¶3214-3217 (4), ¶¶3364-3365 (9). But Wang does not teach or suggest these limitations.

1688. Dr. Hansen primarily relies on these passages and figures from Wang:

> In FIG. 27, a STA sends a PS-Poll frame 2702 to an AP to retrieve data. The AP responds with an ACK 2704 with a More Data field set to '1' and a Response Frame field set to "11." The AP then sends a data frame 2706 with a More Data field set to '0' and a Response Frame set to "00." The STA receives the data frame 2706 and sends an ACK frame 2708 with a More Data field set to '0' and a Response Frame field set to "10."

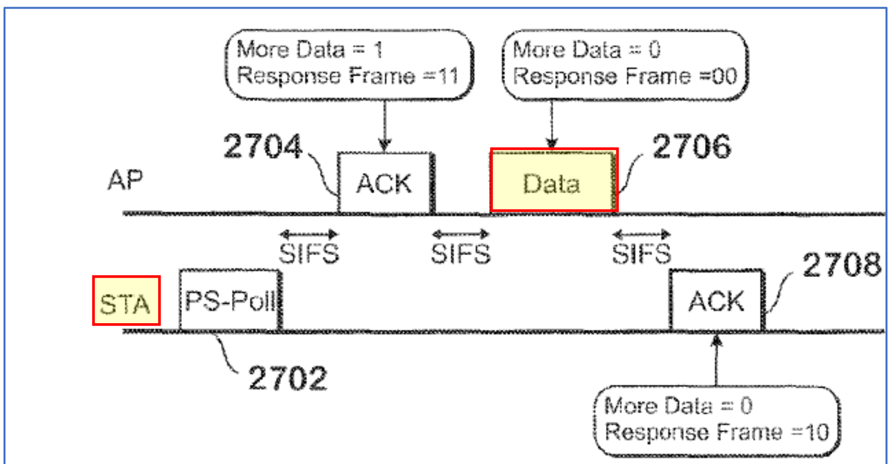


FIG. 27

> In FIG. 28, a STA sends a data frame 2802 to an AP with a More Data field set to '1' and a Response Frame field set to "00." The AP then sends an ACK frame 2804 with a More Data field set to '0' and a Response Frame field set to "11." The STA then sends another data frame 2806 with a More Data field set to "0' and a Response Frame field set to "00." The AP then sends an ACK frame 2808 with a More Data field set to '0' and a Response Frame field set to "10."

[redacted]

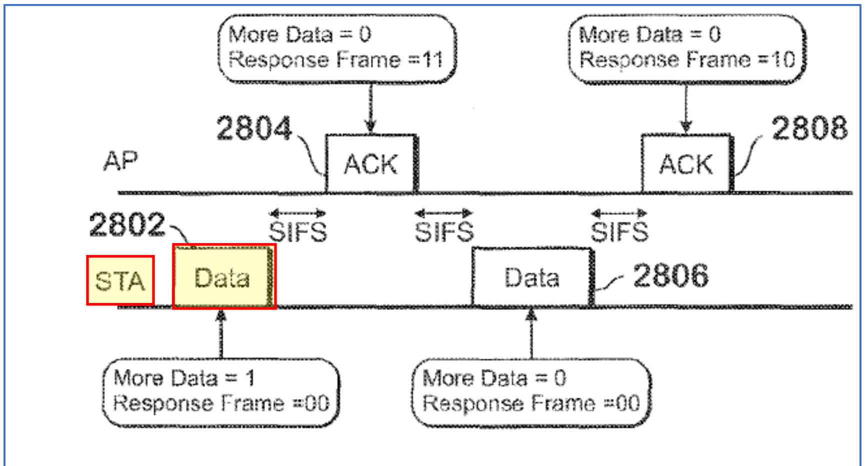


FIG. 28

Hansen Report at ¶3215 (citing Wang at [0176]-[0179], Figs. 27-28) (emphasis added). But Figure 27 only shows DL data 2706 for one STA—not "a plurality of STAs," as claimed. And Figure 28 shows only UL data 2802 for an AP—not "downlink data for a plurality of STAs," as claimed.

1689. For these reasons, it is my opinion that Wang does not teach or suggest these claim limitations.

13.6.3.6 Wang Fails to Teach or Suggest that the "Downlink Frame Includes Block Acknowledgement (ACK) Requests for a Plurality of STAs Including the STA and the At Least One Other STA" (5, 10)

1690. Dependent claims 5 and 10 of the '679 Patent require that "the downlink frame includes block acknowledgement (ACK) requests for a plurality of STAs including the STA and the at least one other STA." '679 at 42:16-19 ('679 cl. 5); 42:58-61 ('679 cl. 10).

1691. Dr. Hansen cites evidence that he asserts proves Wang discloses these limitations. Hansen Report at ¶¶3251-3257 (5), ¶¶3376-3377 (10). But Wang does not teach or suggest these limitations.

1692. The only disclosure of a Block ACK Request or BAR in Dr. Hansen's cited passages from Wang relates to Wang Figure 9:

> FIG. 9 shows an example message exchange sequence for delayed MU-MIMO block ACK. STA1 acquires a channel and negotiates with an AP with a few message exchanges 910 to set up a block ACK session with the AP with delayed

[redacted]

block ACK policy. **<u>An originator (STA1 in this example) transmits</u>** data, followed by **<u>a block ACK request (BAR) 914. The BAR frame 914 solicits an ACK frame 916 from the recipient (AP in this example).</u>** FIG. 10 shows a BAR frame format. The BAR frame 914 includes a BAR control field 1002. If a BAR ACK policy field in the BAR control field 1002 is set to '1', the recipient returns an ACK immediately upon receipt of the BAR frame 914. If a BAR ACK policy field in the BAR control field 1002 is set to '0', the recipient does not send an ACK upon receipt of the BAR frame 914. In the example shown in FIG. 9, **<u>the AP sends an ACK 916 in response to the BAR frame 914.</u>**

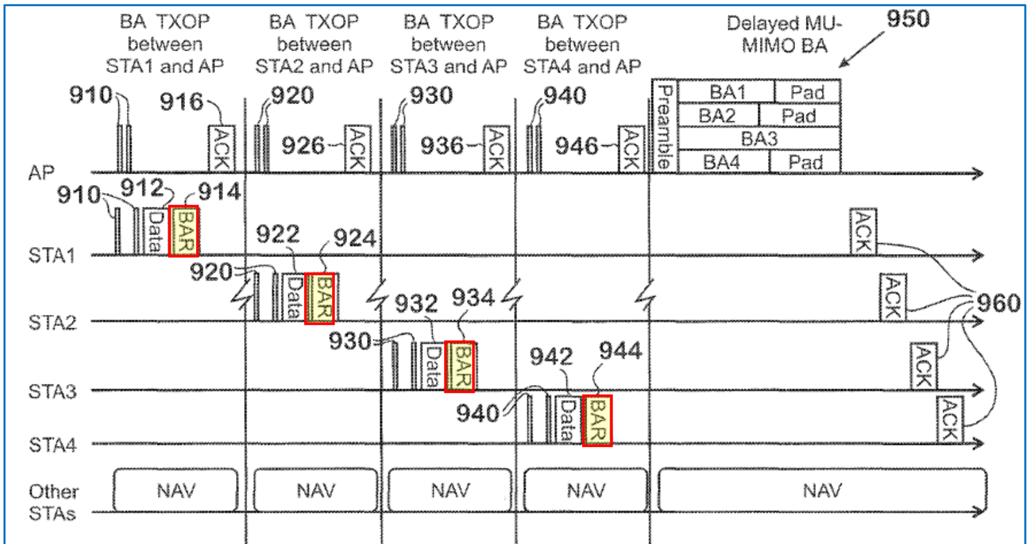


FIG. 9

Hansen Report at ¶3252 (citing Wang at [0101], Fig. 9) (emphasis added). As can be seen, the BAR 914 is transmitted in the uplink direction from STA1 to the AP—not as part of the "downlink frame," as claimed. Further, the BAR 914 is only for a single AP—not "for a plurality of STAs," as claimed.

1693. For these reasons, it is my opinion that Wang does not teach or suggest these claim limitations.

[redacted]

13.6.4 Zhu Fails To Disclose Or Render Obvious Any '679 Claim Limitation

13.6.4.1 Zhu Fails to Teach or Suggest a "Downlink Frame Including a QoS Control Field Including Acknowledgment Information representing Whether the STA Is Requested to Transmit the Acknowledgment Frame in a Single-User Format Or In A Multiple-User Format At A Short Inter-Frame Space (SIFS) Time After the Downlink Frame" (1A, 6A)

1694. Each of the '679 claims require a "downlink frame including a quality of service (QoS) control field including acknowledgement information representing whether the STA is requested to transmit the acknowledgement frame in a single-user (SU) format or in a multiple-user (MU) format at a Short Inter-Frame Space (SIFS) time after the downlink frame." '679 at 41:41-47 ('679 cl. 1); 42:24-30 ('679 cl. 6).

1695. Dr. Hansen cites evidence that he asserts proves Zhu discloses these limitations. Hansen Report at ¶¶3037-3043 (1[a]), ¶¶3294-3295 (6[a]). But Zhu does not teach or suggest these limitations, as described below.

1696. None of the Zhu passages cited by Dr. Hansen even hint at '679 claim concepts like a "QoS control field," "acknowledgment information," "single-user format," "multiple-user format," or "SIFS"—much less use those words. The closest Zhu comes to these '679 claim limitations is bare mentions of "multiuser MIMO" and "Single User MIMO." *E.g.*, Zhu at [0020] ("A kind of is that under the **MU-MIMO pattern**, the frame that **AP sends** comprises the packet header of sending through the **VHT-SIG-A signaling**, and the data flow of each STA of correspondence that after packet header, sends through the **MU-MIMO** spatial multiplexing mode.") (emphasis added); *id.* at [0021] ("Another kind is that under the **SU-MIMO pattern**, the frame that **AP sends** comprises the packet header of sending through the **VHT-SIG-A signaling**, and the data flow of giving a STA of after packet header, sending.") (emphasis added). But at best, those passages simply teach that an AP may send a DL MU-MIMO or SU-MIMO frame. None of those passages teach or suggest that a STA can send an UL acknowledgment in MU-MIMO or SU-MIMO mode based on acknowledgment information in the DL frame. Indeed, that would be impossible,

[redacted]

given that those Zhu passages teach to use "VHT-SIG-A signaling" from 802.11ac—which did not permit UL MU MIMO. *See supra.*

1697. For these reasons, it is my opinion that Zhu does not teach or suggest these claim limitations.

13.6.4.2 Zhu Fails to Teach or Suggest Transmitting Or Receiving an "Acknowledgement Frame Based On The Acknowledgement Information At The SIFS Time After The Downlink Frame" (1B, 6B)

1698. Each of the '679 claims require either transmitting or receiving "the acknowledgement frame based on the acknowledgement information at the SIFS time after the downlink frame." '679 at 41:48-50 ('679 cl. 1); 42:31-33 ('679 cl. 6).

1699. Dr. Hansen cites evidence that he asserts proves Zhu discloses these limitations. Hansen Report at ¶¶3066-3072 (1[b]), ¶¶3306-3307 (6[b]). But Zhu does not teach or suggest these limitations. As discussed above, Zhu does not disclose the claimed "acknowledgement information" that can represent whether to transmit an acknowledgment frame in "multiple-user format" or "single-user format" a "SIFS" after receiving the downlink frame. *See supra.* None of the Zhu passages cited by Dr. Hansen even hint at '679 claim concepts like "acknowledgment information," or "SIFS"—much less use those words. Accordingly, Zhu cannot disclose transmitting/receiving an acknowledgment frame based on the non-existent "acknowledgment information."

1700. For these reasons, it is my opinion that Zhu does not teach or suggest these claim limitations.

[redacted]

13.6.4.3 Zhu Fails to Teach or Suggest Transmitting Or Receiving "the Acknowledgement Frame in the MU Format On The Allocated Resource Simultaneously With Transmission of At Least One Acknowledgement Frame From At Least One Other STA" "When The Acknowledgment Information Represents that the STA Is Requested To Transmit the Acknowledgement Frame in the MU Format and The STA is Allocated a Resource" (1C, 6C)

1701. Each of the '679 claims require either transmitting or receiving "the acknowledgement frame in the MU format on the allocated resource simultaneously with transmission of at least one acknowledgement frame from at least one other STA" "when the acknowledgment information represents that the STA is requested to transmit the acknowledgement frame in the MU format and the STA is allocated a resource." '679 at 41:51-60 ('679 cl. 1); 42:34-41 ('679 cl. 6).

1702. Dr. Hansen cites evidence that he asserts proves Zhu discloses these limitations. Hansen Report at ¶¶3096-3102 (1[c]), ¶¶3318-3319 (6[c]). But Zhu does not teach or suggest these limitations.

1703. As discussed above, Zhu does not disclose the claimed "acknowledgement information" or "MU format." *See supra.* None of the Zhu passages cited by Dr. Hansen even hint at '679 claim concepts like "acknowledgment information," or "MU format" for an UL acknowledgment frame—much less use those words. Accordingly, Zhu cannot disclose transmitting/receiving an acknowledgment frame in the non-existent "multiple-user format" based on the non-existent "acknowledgment information."

1704. For these reasons, it is my opinion that Zhu does not teach or suggest these claim limitations.

13.6.4.4 Zhu Fails to Teach or Suggest Transmitting Or Receiving "the Acknowledgement Frame in the SU Format" "When The Acknowledgment Information Represents that the STA is Requested To Transmit the Acknowledgement Frame in the SU Format" (1D, 6D)

1705. Each of the '679 claims require either transmitting or receiving "the acknowledgement frame in the SU format" "when the acknowledgment information

[redacted]

represents that the STA is requested to transmit the acknowledgement frame in the SU format." '679 at 41:61-42:2 ('679 cl. 1); 42:42-45 ('679 cl. 6).

1706. Dr. Hansen cites evidence that he asserts proves Zhu discloses these limitations. Hansen Report at ¶¶3123-3129 (1[d]), ¶¶3330-3331 (6[d]). But Zhu does not teach or suggest these limitations.

1707. As discussed above, Zhu does not disclose the claimed "acknowledgement information" or "SU format." *See supra.* None of the Zhu passages cited by Dr. Hansen even hint at '679 claim concepts like "acknowledgment information," or "SU format" for an UL acknowledgment frame—much less use those words. Accordingly, Zhu cannot disclose transmitting/receiving an acknowledgment frame in the single-user format based on the non-existent "acknowledgment information."

1708. For these reasons, it is my opinion that Zhu does not teach or suggest these claim limitations.

13.6.4.5 Zhu Fails to Teach or Suggest that the "Downlink Frame Further Includes Modulation and Coding Scheme (MCS) Information for the Acknowledgement Frame" (2, 7)

1709. Dependent claims 2 and 7 of the '679 Patent require that the "downlink frame further includes Modulation and Coding Scheme (MCS) information for the acknowledgement frame." '679 at 42:3-6 ('679 cl. 2); 42:46-49 ('679 cl. 7).

1710. Dr. Hansen cites evidence that he asserts proves Zhu discloses these limitations. Hansen Report at ¶¶3154-3160 (2), ¶¶3342-3343 (7). But Zhu does not teach or suggest these limitations. None of the Zhu passages cited by Dr. Hansen even hint at '679 claim concepts like "Modulation and Coding Scheme" or "MCS"—much less use those words. *Id.*

1711. For these reasons, it is my opinion that Zhu does not teach or suggest these claim limitations.

[redacted]

13.6.4.6 Zhu Fails to Teach or Suggest that "A Same MCS Based on the MCS Information is Applied to the Acknowledgement Frame by the STA and The at Least One Other STA" (3, 8)

1712. Dependent claims 3 and 8 of the '679 Patent require that "a same MCS based on the MCS information is applied to the acknowledgement frame by the STA and the at least one other STA." '679 at 42:7-10 ('679 cl. 3); 42:50-53 ('679 cl. 8).

1713. Dr. Hansen cites evidence that he asserts proves Zhu discloses these limitations. Hansen Report at ¶¶3182-3188 (3), ¶¶3354-3355 (8). But Zhu does not teach or suggest these limitations. None of the Zhu passages cited by Dr. Hansen even hint at '679 claim concepts like "Modulation and Coding Scheme" or "MCS"—much less use those words. *Id.*

1714. For these reasons, it is my opinion that Zhu does not teach or suggest these claim limitations.

13.6.4.7 Zhu Fails to Teach or Suggest that the "Downlink Frame Includes Block Acknowledgement (ACK) Requests for a Plurality of STAs Including the STA and the At Least One Other STA" (5, 10)

1715. Dependent claims 5 and 10 of the '679 Patent require that "the downlink frame includes block acknowledgement (ACK) requests for a plurality of STAs including the STA and the at least one other STA." '679 at 42:16-19 ('679 cl. 5); 42:58-61 ('679 cl. 10).

1716. Dr. Hansen cites evidence that he asserts proves Zhu discloses these limitations. Hansen Report at ¶¶3258-3264 (5), ¶¶3378-3379 (10). But Zhu does not teach or suggest these limitations. None of the Zhu passages cited by Dr. Hansen even hint at '679 claim concepts like multiple "Block ACK Requests" or "BARs"—much less use those words. *Id.*

1717. For these reasons, it is my opinion that Zhu does not teach or suggest these claim limitations.

[redacted]

13.6.5 Banerjea Fails To Disclose Or Render Obvious Any '679 Claim Limitations

13.6.5.1 Banerjea Fails to Teach or Suggest a Method for Transmitting or Receiving "An Acknowledgment Frame For Notifying Successful Data Reception" "In A Wireless Local Area Network" (1PRE, 6PRE)

1718. Each of the '679 claims require a method for transmitting or receiving "an acknowledgement frame for notifying successful data reception [] in a wireless local area network." '679 at 41:37-40 ('679 cl. 1); 42:20-23 ('679 cl. 6).

1719. Dr. Hansen cites evidence that he asserts proves Banerjea discloses these limitations. Hansen Report at ¶¶3012-3013 (1[pre]), ¶¶3284-3285 (6[pre]). But Banerjea does not teach or suggest these limitations, as described below.

1720. Dr. Hansen only relies on one passage to show that Banerjea has the claimed methods:

> In an embodiment, a method in a receiving device that receives data from a plurality of transmitting devices via a shared wireless communication channel includes selecting a group of two or more transmitting devices from the plurality of transmitting devices for **simultaneous transmission of respective data to the receiving device**, so that each transmitting device in the group of transmitting devices transmits the respective data to the receiving device at a nominal power level of the transmitting device, and **receiving the respective data from each in the group of transmitting devices simultaneously** via the shared wireless communication channel.

Hansen Report at ¶3012 (citing Banerjea at 1:44-54) (emphasis added). As is readily apparent, nothing in that passage (nor any other in Banerjea) discloses STAs that transmit acknowledgment frames to an AP. Indeed the term "acknowledge" (nor any of its variants) is found in Banerjea. At most, that passage relates to two devices simultaneously transmitting and receiving data.

1721. For these reasons, it is my opinion that Banerjea does not teach or suggest these claim limitations.

[redacted]

13.6.5.2 Banerjea Fails to Teach or Suggest a "Downlink Frame Including a QoS Control Field Including Acknowledgment Information representing Whether the STA Is Requested to Transmit the Acknowledgment Frame in a Single-User Format Or In A Multiple-User Format At A Short Inter-Frame Space (SIFS) Time After the Downlink Frame" (1A, 6A)

1722. Each of the '679 claims require a "downlink frame including a quality of service (QoS) control field including acknowledgement information representing whether the STA is requested to transmit the acknowledgement frame in a single-user (SU) format or in a multiple-user (MU) format at a Short Inter-Frame Space (SIFS) time after the downlink frame." '679 at 41:41-47 ('679 cl. 1); 42:24-30 ('679 cl. 6).

1723. Dr. Hansen cites evidence that he asserts proves Banerjea discloses these limitations. Hansen Report at ¶¶3044-3052 (1[a]), ¶¶3296-3297 (6[a]). But Banerjea does not teach or suggest these limitations, as described below.

1724. While Banerjea teaches that STAs in the same group receive an uplink assignment indicator (USI) frame that can notify those STAs to transmit UL data frames a SIFS later (*e.g.*, at 3:49-56, 6:46-56), Banerjea never teaches that the USI includes a QoS control field with acknowledgment information, or that the STA may transmit acknowledgments in single-user or multi-user format, as claimed.

1725. As shown below, Figure 4 from Banerjea illustrates the contents of the USI, and it has neither a QoS control field nor acknowledgment information:

[redacted]

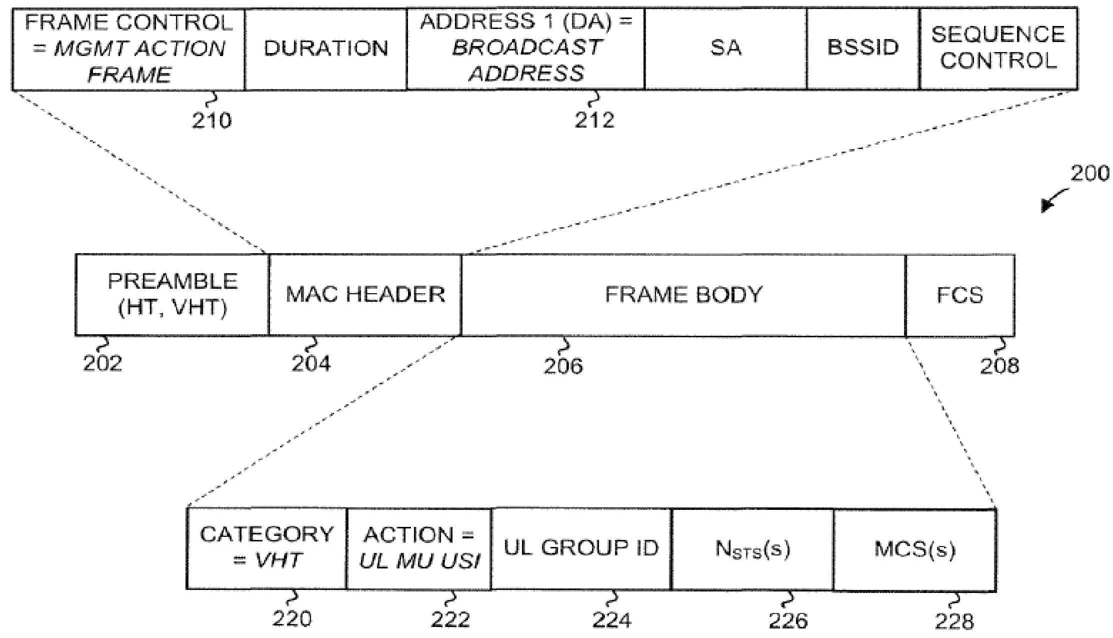


FIG. 4

Banerjea at 7:34-67; Fig. 4.

1726. For these reasons, it is my opinion that Banerjea does not teach or suggest these claim limitations.

13.6.5.3 Banerjea Fails to Teach or Suggest Transmitting Or Receiving an "Acknowledgement Frame Based On The Acknowledgement Information At The SIFS Time After The Downlink Frame" (1B, 6B)

1727. Each of the '679 claims require either transmitting or receiving "the acknowledgement frame based on the acknowledgement information at the SIFS time after the downlink frame." '679 at 41:48-50 ('679 cl. 1); 42:31-33 ('679 cl. 6).

1728. Dr. Hansen cites evidence that he asserts proves Banerjea discloses these limitations. Hansen Report at ¶¶3073-3081 (1[b]), ¶¶3308-3309 (6[b]). But Banerjea does not teach or suggest these limitations. As discussed above, Banerjea does not disclose the claimed "acknowledgement information" that can represent whether to transmit an acknowledgment frame in "multiple-user format" or "single-user format." *See supra.* Banerjea has nothing to do with STAs that transmit acknowledgment information to the

[redacted]

AP; indeed, Banerjea never uses the term "acknowledge." Accordingly, Banerjea cannot disclose transmitting/receiving an acknowledgment frame based on the non-existent "acknowledgment information."

1729. For these reasons, it is my opinion that Banerjea does not teach or suggest these claim limitations.

13.6.5.4 Banerjea Fails to Teach or Suggest Transmitting Or Receiving "the Acknowledgement Frame in the MU Format On The Allocated Resource Simultaneously With Transmission of At Least One Acknowledgement Frame From At Least One Other STA" "When The Acknowledgment Information Represents that the STA Is Requested To Transmit the Acknowledgement Frame in the MU Format and The STA is Allocated a Resource" (1C, 6C)

1730. Each of the '679 claims require either transmitting or receiving "the acknowledgement frame in the MU format on the allocated resource simultaneously with transmission of at least one acknowledgement frame from at least one other STA" "when the acknowledgment information represents that the STA is requested to transmit the acknowledgement frame in the MU format and the STA is allocated a resource." '679 at 41:51-60 ('679 cl. 1); 42:34-41 ('679 cl. 6).

1731. Dr. Hansen cites evidence that he asserts proves Banerjea discloses these limitations. Hansen Report at ¶¶3103-3111 (1[c]), ¶¶3320-3321 (6[c]). But Banerjea does not teach or suggest these limitations.

1732. As discussed above, Banerjea does not disclose the claimed "acknowledgement information." *See supra.* Banerjea has nothing to do with STAs that transmit acknowledgment information to the AP; indeed, Banerjea never uses the term "acknowledge." Accordingly, Banerjea cannot disclose transmitting/receiving an acknowledgment frame in the multiple-user format based on the non-existent "acknowledgment information." And while Banerjea teaches simultaneously transmitting UL Data frames (*e.g.*, at Fig. 3A), those UL Data frames are not the claimed "acknowledgment frame."

[redacted]

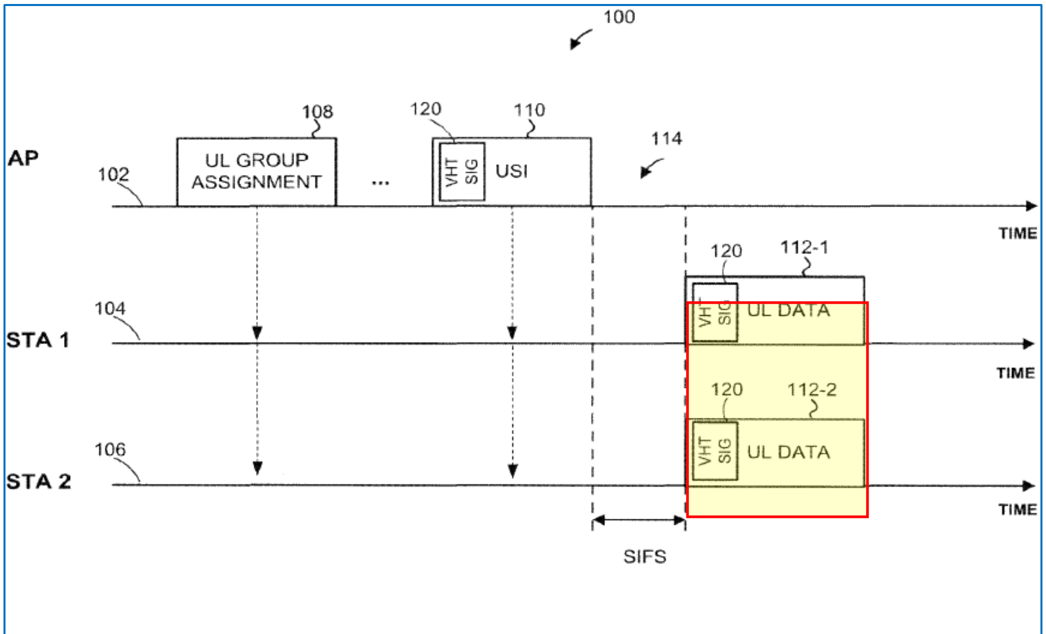


FIG. 3A

Banerjea at Fig. 3A (emphasis added).

1733. For these reasons, it is my opinion that Banerjea does not teach or suggest these claim limitations.

13.6.5.5 Banerjea Fails to Teach or Suggest Transmitting Or Receiving "the Acknowledgement Frame in the SU Format" "When The Acknowledgment Information Represents that the STA is Requested To Transmit the Acknowledgement Frame in the SU Format" (1D, 6D)

1734. Each of the '679 claims require either transmitting or receiving "the acknowledgement frame in the SU format" "when the acknowledgment information represents that the STA is requested to transmit the acknowledgement frame in the SU format." '679 at 41:61-42:2 ('679 cl. 1); 42:42-45 ('679 cl. 6).

1735. Dr. Hansen cites evidence that he asserts proves Banerjea discloses these limitations. Hansen Report at ¶¶3130-3138 (1[d]), ¶¶3332-3333 (6[d]). But Banerjea does not teach or suggest these limitations.

1736. As discussed above, Banerjea does not disclose the claimed "acknowledgement information." *See supra.* Banerjea has nothing to do with STAs that transmit acknowledgment information to the AP; Banerjea never uses the term "acknowledge."

Accordingly, Banerjea cannot disclose transmitting/receiving an acknowledgment frame in the single-user format based on the non-existent "acknowledgment information." Banerjea does not explicitly disclose any "acknowledgment frame," much less any "SU format."

1737. For these reasons, it is my opinion that Banerjea does not teach or suggest these claim limitations.

13.6.5.6 Banerjea Fails to Teach or Suggest that the "Downlink Frame Further Includes Modulation and Coding Scheme (MCS) Information for the Acknowledgement Frame" (2, 7)

1738. Dependent claims 2 and 7 of the '679 Patent require that the "downlink frame further includes Modulation and Coding Scheme (MCS) information for the acknowledgement frame." '679 at 42:3-6 ('679 cl. 2); 42:46-49 ('679 cl. 7).

1739. Dr. Hansen cites evidence that he asserts proves Banerjea discloses these limitations. Hansen Report at ¶¶3161-3169 (2), ¶¶3344-3345 (7). But Banerjea does not teach or suggest these limitations. While Banerjea teaches a USI downlink frame that includes an MCS subfield 228 for "specif[ying] the identified MCS to the stations [in the group]" (at 8:7-10, Fig. 4), that MCS is not used by any non-existent "acknowledgment frame," as claimed.

[redacted]

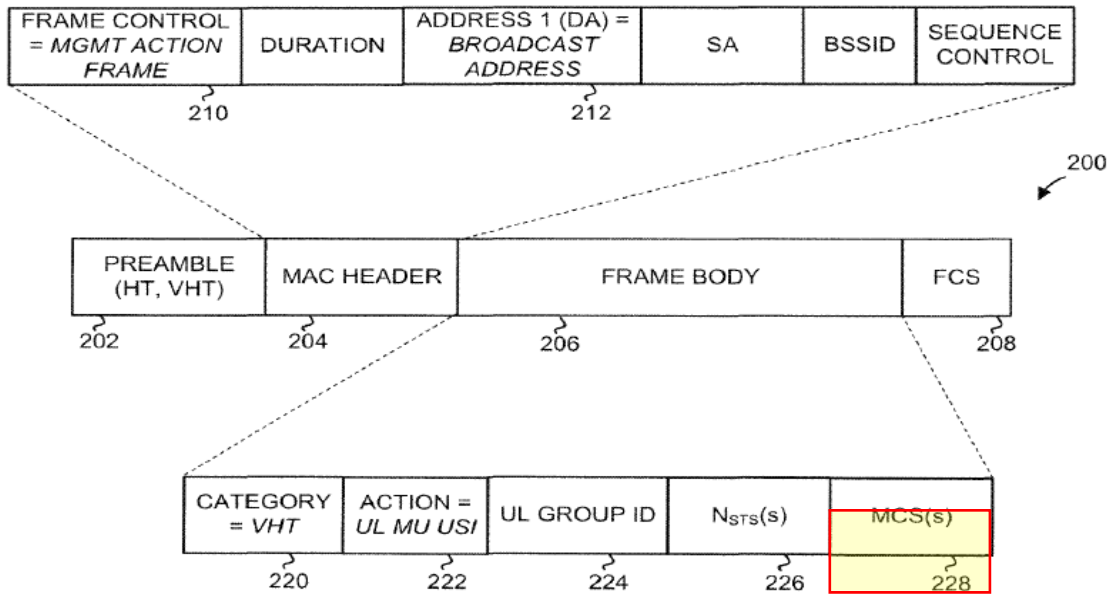


FIG. 4

Banerjea Fig. 4 (emphasis added).

1740. For these reasons, it is my opinion that Banerjea does not teach or suggest these claim limitations.

13.6.5.7 Banerjea Fails to Teach or Suggest that "A Same MCS Based on the MCS Information is Applied to the Acknowledgement Frame by the STA and The at Least One Other STA" (3, 8)

1741. Dependent claims 3 and 8 of the '679 Patent require that "a same MCS based on the MCS information is applied to the acknowledgement frame by the STA and the at least one other STA." '679 at 42:7-10 ('679 cl. 3); 42:50-53 ('679 cl. 8).

1742. Dr. Hansen cites evidence that he asserts proves Banerjea discloses these limitations. Hansen Report at ¶¶3189-3197 (3), ¶¶3356-3357 (8). But Banerjea does not teach or suggest these limitations. As discussed above, Banerjea never teaches that STAs transmit "acknowledgment frames." Thus, Banerjea cannot teach that STAs use the MCS from a USI downlink frame when transmitting [non-existent] "acknowledgment frames," as claimed.

[redacted]

1743. For these reasons, it is my opinion that Banerjea does not teach or suggest these claim limitations.

13.6.5.8 Banerjea Fails to Teach or Suggest that the "Downlink Frame Includes Downlink Data For a Plurality of STAs" (4, 9)

1744. Dependent claims 4 and 90 of the '679 Patent require that "the downlink frame includes downlink data for a plurality of STAs including the STA and the at least one other STA." '679 at 42:11-14 ('679 cl. 4); 42:54-57 ('679 cl. 9).

1745. Dr. Hansen cites evidence that he asserts proves Banerjea discloses these limitations. Hansen Report at ¶¶3225-3233 (4), ¶¶3368-3369 (9). But Banerjea does not teach or suggest these limitations. While the USI "downlink frames" contain much information (*e.g.*, at 7:34-67, Fig. 4), nowhere does Banerjea teach the USI downlink frame "includes downlink data for a plurality of STAs," as claimed.

1746. For these reasons, it is my opinion that Banerjea does not teach or suggest these claim limitations.

13.6.5.9 Banerjea Fails to Teach or Suggest that the "Downlink Frame Includes Block Acknowledgement (ACK) Requests for a Plurality of STAs Including the STA and the At Least One Other STA" (5, 10)

1747. Dependent claims 5 and 10 of the '679 Patent require that "the downlink frame includes block acknowledgement (ACK) requests for a plurality of STAs including the STA and the at least one other STA." '679 at 42:16-19 ('679 cl. 5); 42:58-61 ('679 cl. 10).

1748. Dr. Hansen cites evidence that he asserts proves Banerjea discloses these limitations. Hansen Report at ¶¶3265-3273 (5), ¶¶3380-3381 (10). But Banerjea does not teach or suggest these limitations. Banerjea discusses the USI "downlink frame" at 7:34-67 and Figure 4. But nowhere does Banerjea teach that the USI includes block ACK requests, as claimed.

1749. For these reasons, it is my opinion that Banerjea does not teach or suggest these claim limitations.

[redacted]

13.6.6 Dr. Hansen's Alleged '679 Prior Art—Even Collectively—Fails To Teach or Suggest Several '679 Claim Limitations, So Any Combination Fails To Render Obvious the '679 Claims

1750. This chart summarizes my '679 validity analysis above. The rows correspond to my shorthand summary of the claim language, and the columns correspond to Dr. Hansen's five references for the '679 Patent (Merlin '690, 802.11ac-2013, Wang, Zhu, and Banerjea). Anytime I concluded above that one of Dr. Hansen's five references did not teach or suggest a claim limitation, I placed a red "X" at the row/column intersection. (Note that the absence of a red "X" does not mean that I agree the reference teaches or suggests the claim limitation.)

'679 Claim Language Shorthand	Merlin '690	802.11ac	Wang	Zhu	Banerjea
[1pre] STA method re transmitting ACKs				X	X
[1a] receiving DL frame with QoS field indicating SU/MU format for ACK after SIFS	X	X	X	X	X
[1b] transmitting ACK after SIFS	X	X	X	X	X
[1c] transmitting ACK in MU format	X	X	X	X	X
[1d] transmitting ACK in SU format	X	X	X	X	X
[2] DL frame includes MCS for ACK	X	X		X	X
[3] multiple STAs use same MCS	X	X		X	X
[4] DL frame has data for multiple STAs			X		X
[5] DL frame includes BAR for multiple STAs		X	X	X	X
[6 pre] AP method re receiving ACKs				X	X
[6a] transmitting DL frame with QoS field indicating SU/MU format for ACK after SIFS	X	X	X	X	X
[6b] receiving ACK after SIFS	X	X	X	X	X
[6c] receiving ACK in MU format	X	X	X	X	X
[6d] receiving ACK in SU format	X	X	X	X	X

[redacted]

'679 Claim Language Shorthand	Merlin '690	802.11ac	Wang	Zhu	Banerjea
[7] DL frame includes MCS for ACK	X	X		X	X
[8] multiple STAs use same MCS	X	X		X	X
[9] DL frame has data for multiple STAs			X		X
[10] DL frame includes BAR for multiple STAs		X	X	X	X

1751. As can be seen, none of Dr. Hansen's references taught or suggested at least '679 claim limitations 1[a], 1[b], 1[c], 1[d], 6[a], 6[b], 6[c], & 6[d]. Consequently, Dr. Hansen's alleged '679 prior art—even collectively, or any in combination thereof—fails to teach or suggest every limitation of the '679 claims. Hence, I understand that Dr. Hansen's '679 art cannot render obvious the '679 claims as a matter of law.

13.6.7 A POSITA Would Not Have Combined Merlin '690, 802.11ac-2013, Wang, Zhu and/or Banerjea

1752. Dr. Hansen alleges that a POSITA would have been motivated to make any combination of Merlin '690, 802.11ac-2013, Wang, Zhu, or Banerjea. Hansen Report at ¶¶2991, 3383-3397. I disagree. Even assuming arguendo that my above analysis is incorrect and there is some combination of Merlin '690, 802.11ac-2013, Wang, Zhu, and/or Banerjea that discloses every limitation of the '679 claims, a POSITA would not have combined those references (or any subset thereof).

1753. There is no apparent reason—apart from improper hindsight—that would have motivated a POSITA to combine together Merlin '690, 802.11ac-2013, Wang, Zhu, or Banerjea. Merlin '690 is a Qualcomm patent filed in October 2014 that was primarily invented by Simone Merlin. Merlin '690 at title page. 802.11ac-2013 is an IEEE standard that began in September 2008 and included contributions from hundreds of disparate individuals. https://standards.ieee.org/ieee/802.11ac/4473/; TPL0001609-1612. Wang is an Interdigital patent filed in May 2013 that was primarily invented by Xiofel Wang. Wang

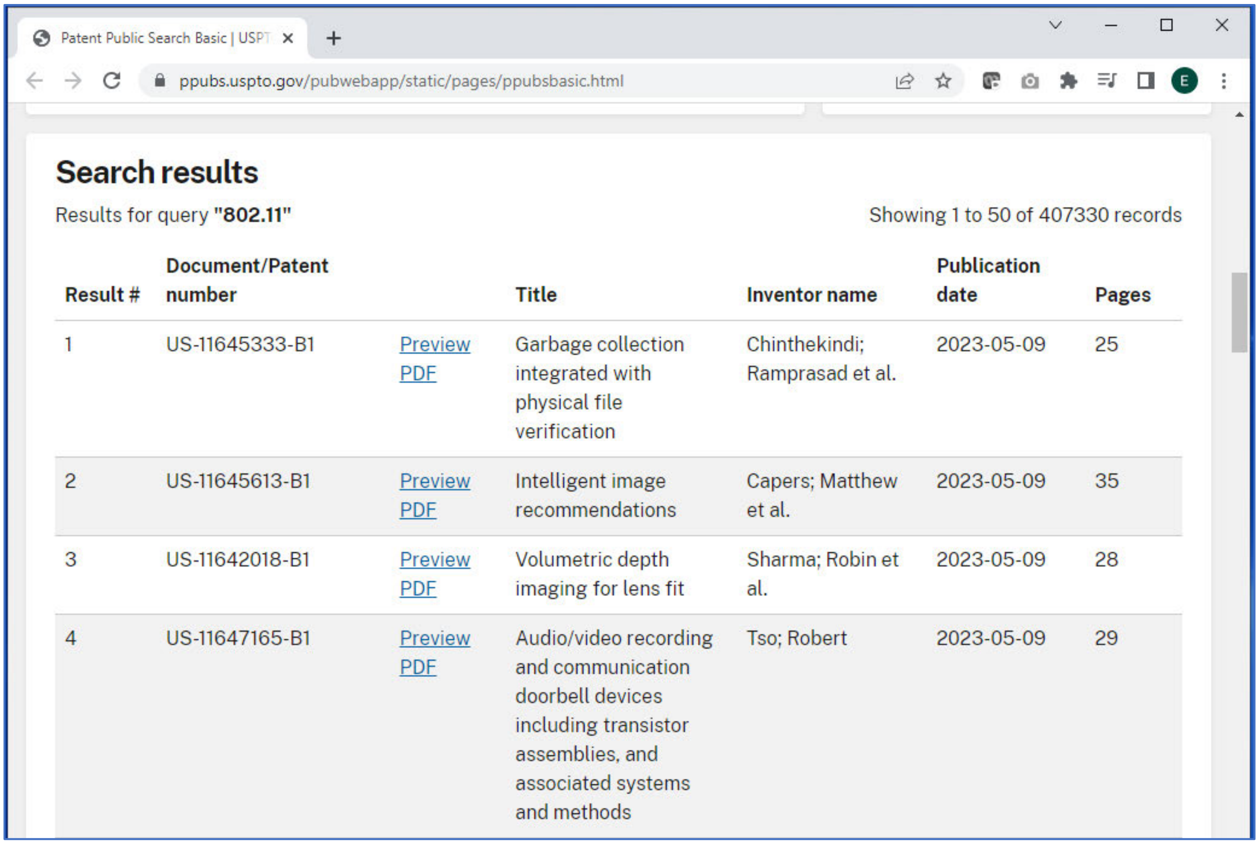
[redacted]

at title page. Zhu is a Huawei patent filed in May 2011 that was primarily invented by Zhu. TPL0020644. And Banerjea is a Marvell patent filed in November 2010 that was primarily invented by Raja Banerjea. Banerjea at title page. As shown above, these five references originate from different companies, were drafted at different times, and have different inventors. Dr. Hansen provides no apparent reason why these references would be combined.

1754. Further, Dr. Hansen's '679 art relates to different technologies. Merlin '690 relates to "frame structures and protocols for uplink multiple user (MU) frame exchanges." Merlin '690 at [0003]. 802-11ac-2013 relates to improvements to 802.11 "providing significantly higher basic service set (BSS) throughput for existing WLAN application areas and to enable new market segments for operation below 6 GHz including distribution of multiple multimedia/data streams." https://standards.ieee.org/ieee/802.11ac/4473/. Wang generally relates to "transmitting acknowledgments in response to data packets." Wang at [0007]. Zhu generally relates to "STA equipment that send data under the power saving mode." TPL0020645 (Zhu at [0002]). And Banerjea generally relates to "controlling power at which signals are transmitted in such communication systems." Banerjea at 1:15-17. These are very different technologies, and a POSITA would not be motivated to combine them. Certainly, Dr. Hansen has not shown why a POSITA would combine these different technologies.

1755. Dr. Hansen's motivation to combine analysis is superficial. First, Dr. Hansen simply attempts to show that each of his five '679 references are "analogous art" because, like the '679 Patent, "each of those references relates to WLAN operation at least according to IEEE 802.11 standards." Hansen Report at ¶3384. Yet even Dr. Hansen admits that "Zhu does not specifically refer to 802.11 standards." *Id.* Notwithstanding, just because references relate to 802.11 standards does not mean a POSITA would have combined them. A search of the USPTO patent database reveals there are 407,330 patents that mention "802.11."

[redacted]



Patent Public Search Basic | USPT

ppubs.uspto.gov/pubwebapp/static/pages/ppubsbasic.html

Search results

Results for query **"802.11"**

Showing 1 to 50 of 407330 records

Result #	Document/Patent number		Title	Inventor name	Publication date	Pages
1	US-11645333-B1	Preview PDF	Garbage collection integrated with physical file verification	Chinthekindi; Ramprasad et al.	2023-05-09	25
2	US-11645613-B1	Preview PDF	Intelligent image recommendations	Capers; Matthew et al.	2023-05-09	35
3	US-11642018-B1	Preview PDF	Volumetric depth imaging for lens fit	Sharma; Robin et al.	2023-05-09	28
4	US-11647165-B1	Preview PDF	Audio/video recording and communication doorbell devices including transistor assemblies, and associated systems and methods	Tso; Robert	2023-05-09	29

https://ppubs.uspto.gov/pubwebapp/static/pages/ppubsbasic.html. By Dr. Hansen's logic, a POSITA would be motivated to make any combination of these 407,330 references. Yet Dr. Hansen fails to show why a POSITA would be motivated to make the particular five-reference combination that he selects. Instead, it appears Dr. Hansen cherry-picked just five of the many references that mention 802.11. This approach uses improper hindsight.

1756. Next, Dr. Hansen argues that each reference is "reasonably pertinent to the problem faced by the ['679 inventor]" so they "would have logically commended themselves to the inventor's attention in considering the problem they were attempting to address." Hansen Report at ¶3385. But Dr. Hansen never identifies what he believes the problem faced by the '679 inventor to be. *Id.*

1757. The '679 Patent explains that prior 802.11 standards like 802.11ac were insufficient and "higher performance is required due to WLAN users' increased use of high volume content." '679 at 1:46-56. Accordingly, the '679 Patent explains that its genesis comes

[redacted]

from "a task group called IEEE ax, High Efficiency WLAN (HEW) standardization." *Id.* at 1:57-58. That 802.11ax standard "aims at improving performance felt by users demanding high-capacity, high-rate services while supporting simultaneous access of numerous stations in an environment in which a plurality of APs is densely deployed and coverage areas of APs overlap." *Id.* at 1:558-64. And a specific problem addressed by the '679 Patent is that, prior to the '679 Patent, "there is no specified method for protecting a transmitted frame and no specified method for determining the type of a response frame in a HEW." *Id.* at 1:65-67. Accordingly, "objects of the present ['679] invention is to provide a method for protecting a transmitted frame and a method for determining the type of a response frame in a High Efficiency WLAN (HEW)" like 802.11ax. *Id.* at 2:3-6.

1758. None of Dr. Hansen's '679 art relates to the same problem of the '679 Patent. *See supra.* Certainly, Dr. Hansen has not shown as much. Hansen Report at ¶¶3385-3386, 3388, 3390, 3392.

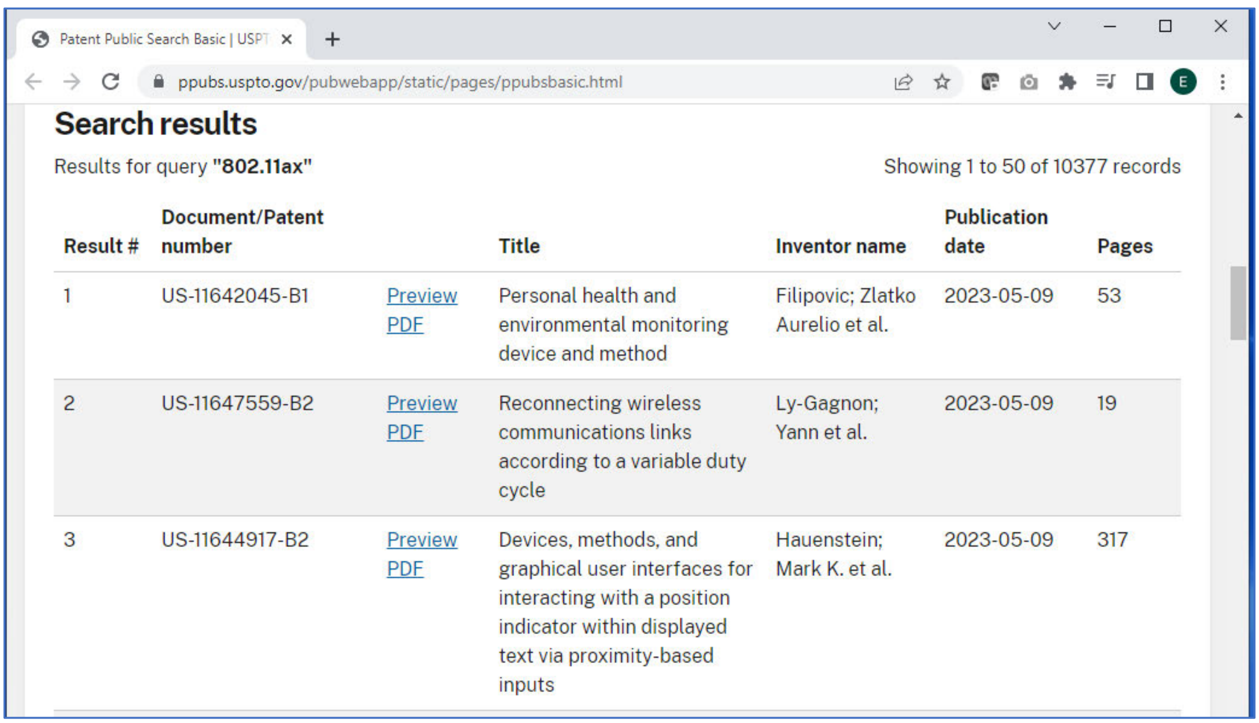
1759. Next, Dr. Hansen goes reference-by-reference and argues that each "discloses teaching, suggestions, and motivations **to use the disclosed system**." Hansen Report at ¶¶3387, 3389, 3391, 3393 (emphasis added). But it is immaterial whether each of Dr. Hansen's references individually teach, suggest, and motivate a POSITA to use the system disclosed by that individual reference. What matters is whether a POSITA would be motivated **to combine references**. Dr. Hansen's analysis is irrelevant to the obviousness issues.

1760. Dr. Hansen next goes reference-by-reference and argues that "a POSITA would appreciate that [the individual reference] discloses these teachings, suggestions, and motivations in context of networks based on IEEE 802.11 standards, including applicability to IEEE 802.11ax standards." Hansen Report at ¶¶3387, 3389, 3391, 3393. This is a species of Dr. Hansen's analogous art argument discussed above. Even if each of Dr. Hansen's five '679 references can be used in an 802.11 context, that does not mean a POSITA would be motivated to combine them. There are many, many 802.11-related

[redacted]

patents, and Dr. Hansen's suggestion to combine these particular '679 references uses improper hindsight.

1761. Dr. Hansen next argues (without any supporting evidence) that "the systems and methods disclosed in Merlin '690, Wang, Zhu, and Banerjea are backward compatible with, and build on 802.11ac-2013," so "a POSITA would have been motivated to combine the teachings of any of Merlin '690, Wang, Zhu, and Banerjea with 802.11ac-2013." Hansen Report at ¶3394. Assuming arguendo that each of those four references is in fact backward compatible with 802.11ac-2013, that does not mean a POSITA would be motivated to combine any of those four references with 802.11ac-2013. There are at least 10,377 patents that mention 802.11ax:



Result #	Document/Patent number		Title	Inventor name	Publication date	Pages
1	US-11642045-B1	Preview PDF	Personal health and environmental monitoring device and method	Filipovic; Zlatko Aurelio et al.	2023-05-09	53
2	US-11647559-B2	Preview PDF	Reconnecting wireless communications links according to a variable duty cycle	Ly-Gagnon; Yann et al.	2023-05-09	19
3	US-11644917-B2	Preview PDF	Devices, methods, and graphical user interfaces for interacting with a position indicator within displayed text via proximity-based inputs	Hauenstein; Mark K. et al.	2023-05-09	317

https://ppubs.uspto.gov/pubwebapp/static/pages/ppubsbasic.html. By Dr. Hansen's logic, a POSITA would be motivated to make any combination of these 10,377 references with 802.11ac (because 802.11ax requires backwards compatibility with 802.11ac). Yet Dr. Hansen fails to show why a POSITA would be motivated to combine any of the particular four references he selects with 802.11ac. Instead, it appears Dr. Hansen cherry-picked just

[redacted]

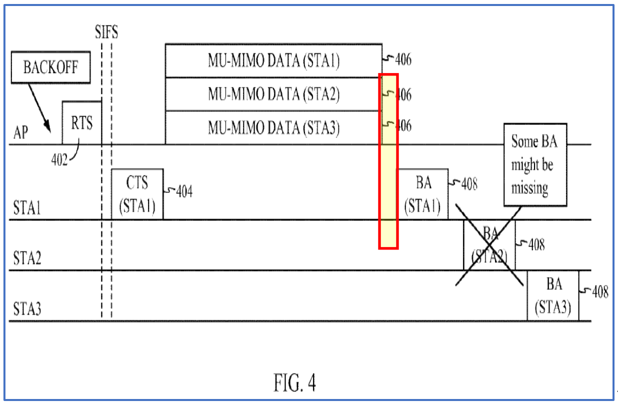
four of the many references that mention 802.11ax. This approach uses improper hindsight.

1762. Next, Dr. Hansen blanketly concludes (without any analysis or supporting evidence) that "at the time of the invention, a POSITA would have had a reasonable expectation of success in combining" these '679 references. Hansen Report at ¶3394. I disagree. Certainly, Dr. Hansen has not provided any evidence or analysis of a reasonable expectation of success.

1763. Next, Dr. Hansen parrots various legal mantras related to obvious: "predictable results," "simple substitution," "reasonable expectation of success," "finite number of identified, predictable solutions," and "design incentives or other market forces." Hansen Report at ¶3395. But he provides no analysis. What are the predictable results? What are the simple substitutions? Why is there a reasonable expectation of success? What are the finite number of identified, predictable solutions? What are the design incentives or other market forces? Dr. Hansen never explains. *Id.* This superficial analysis does not meet his burden.

1764. Finally, Dr. Hansen identifies two specific combinations that he alleges render the '679 claims obvious. First, Dr. Hansen specifically alleges that it would be obvious to modify Merlin '690 (which only teaches certain "immediate response" acknowledgments) to instead send acknowledgments "a SIFS after the downlink frame" (as allegedly taught by 802.11ac and Wang). Hansen Report at ¶3396. Basically, Dr. Hansen argues to combine Merlin Fig. 4 (left) with 802.11ac Fig. 9-9a (right) to arrive at modified Merlin Fig. 4 (bottom):

[redacted]



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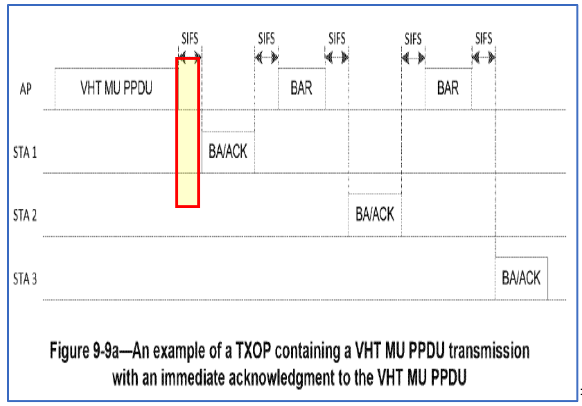

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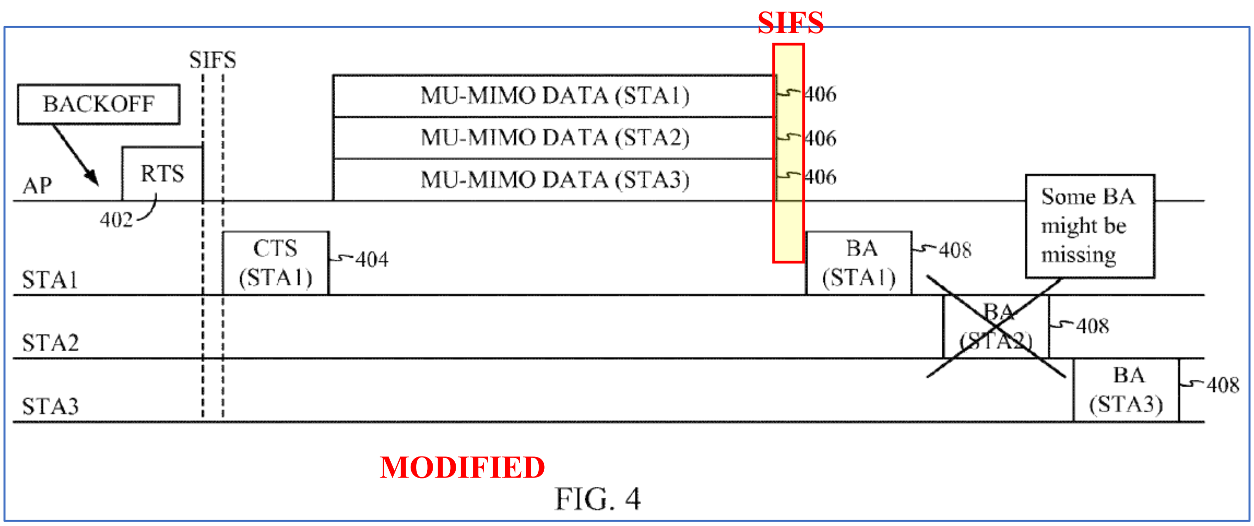
Merlin Fig. 4 (annotations added) 802.11ac Fig. 9-9a (annotations added)



Modified Merlin Fig. 4 (annotations added)

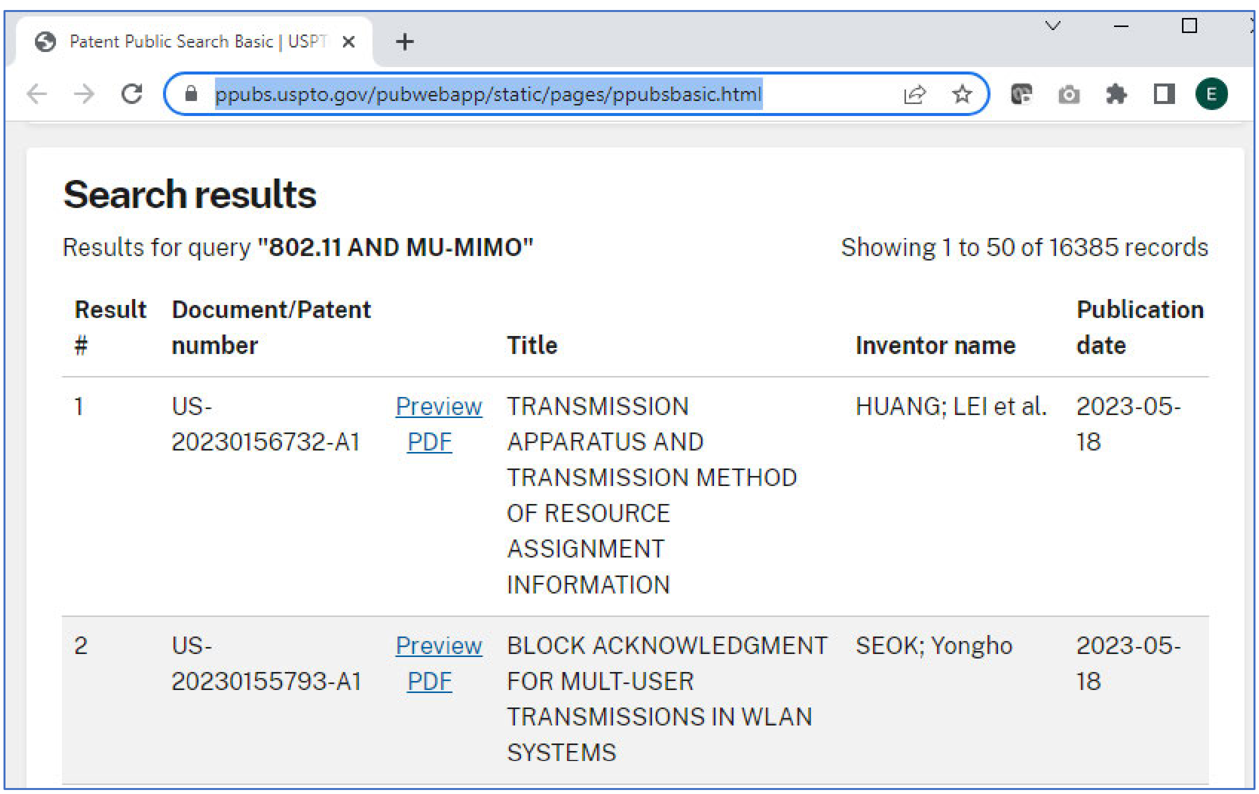
1765. But even if this modification were made, Merlin '690 as modified would still not meet all the limitations of the '679 claims. As shown above, Merlin '690 failed to teach or suggest numerous '679 claim limitations. And Dr. Hansen's proposed modification only directly relates to '679 1[a]-[b] and 6[a]-[b]. Consequently, even this modification to Merlin '690 still fails to invalidate the '679 claims.

1766. Further, Dr. Hansen's motivation to modify Merlin '690 as shown above—namely, that each of the references are "directed to IEEE 802.11 WLAN technology," "directed to improvements to 802.11ac-2013," and "discuss acknowledgments of packets in context of short inter-frame space (SIFS) intervals and single-user and multi-user WLANs based on

[redacted]

802.11 standards" is superficial and fails for the same reasons discussed above. It smacks of improper hindsight.

1767. Second, Dr. Hansen specifically alleges that it would be obvious to combine Merlin '690, 802.11ac-2013, and/or Wang with either or both of Zhu or Banerjea. Hansen Report at ¶3397. Yet Dr. Hansen never explains how he would modify Merlin '690, 802.11ac-2013, and/or Wang to incorporate any of the teachings of Zhu and/or Banerjea. Instead, he merely copy-pastes a single passage from Zhu with no analysis whatsoever, and a single passage from Banerjea, again with no analysis whatsoever. Accordingly, Dr. Hansen has failed to properly explain this obviousness combination. Further, Dr. Hansen's sole motivation for making this combination is that both Zhu and Banerjea "are directed to 802.11 WLAN technology including SU-MIMO and MU-MIMO formats." *Id.* That is insufficient. Indeed, there are 16,385 patents that relate to both "802.11" and "MU-MIMO," and Dr. Hansen offers no apparent reason to pick Zhu and Banerjea—apart from improper hindsight:



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ppubs.uspto.gov/pubwebapp/static/pages/ppubsbasic.html

Search results

Results for query **"802.11 AND MU-MIMO"** Showing 1 to 50 of 16385 records

Result #	Document/Patent number		Title	Inventor name	Publication date
1	US-20230156732-A1	Preview PDF	TRANSMISSION APPARATUS AND TRANSMISSION METHOD OF RESOURCE ASSIGNMENT INFORMATION	HUANG; LEI et al.	2023-05-18
2	US-20230155793-A1	Preview PDF	BLOCK ACKNOWLEDGMENT FOR MULT-USER TRANSMISSIONS IN WLAN SYSTEMS	SEOK; Yongho	2023-05-18

[redacted]

https://ppubs.uspto.gov/pubwebapp/static/pages/ppubsbasic.html. But even if this combination were made, it would still not meet all the limitations of the ‘679 claims. As shown above, even the combination of these five references fails to teach or suggest numerous ‘679 claim limitations. Consequently, even this combination still fails to invalidate the ‘679 claims.

14. THE ART REFERENCED IN THE HANSEN REPORT DOES NOT INVALIDATE THE ASSERTED CLAIMS OF THE ‘919 PATENT

14.1 Overview of the ‘919 Patent

1768. The ’919 Patent is titled “Protection methods for wireless transmissions.” SER-1001. It was invented by Dae Won Lee, Young Hoon Kwon, Yujin Noh, Sungho Moon, and Ahmad Reza Hedayat while working on the next-generation Wi-Fi 6 802.11ax standard at Newracom. *Id.* The ’919 Patent claims priority to October 12, 2015. *Id.* It issued on July 10, 2018. *Id.*

1769. The ’919 Patent generally relates to 802.11ax transmissions, and more specifically to 802.11ax sounding methods that allow both single-user (“SU”) and multi-user (“MU”) uplink feedback.’919 at 1:20-24, 6:27-33, 18:16-18.

1770. Multi-user OFDMA or MU-MIMO allows stations to transmit data to an access point simultaneously. ’919 at 18:26-29. To reduce sounding overhead, these techniques can also be used to transmit sounding information to an access point. *Id.* Thus, the ’919 Patent describes two procedures for providing sounding feedback, a single-user method and a multi-user method. These are illustrated in Figures 8A and 8B, respectively:

[redacted]

FIG. 8A

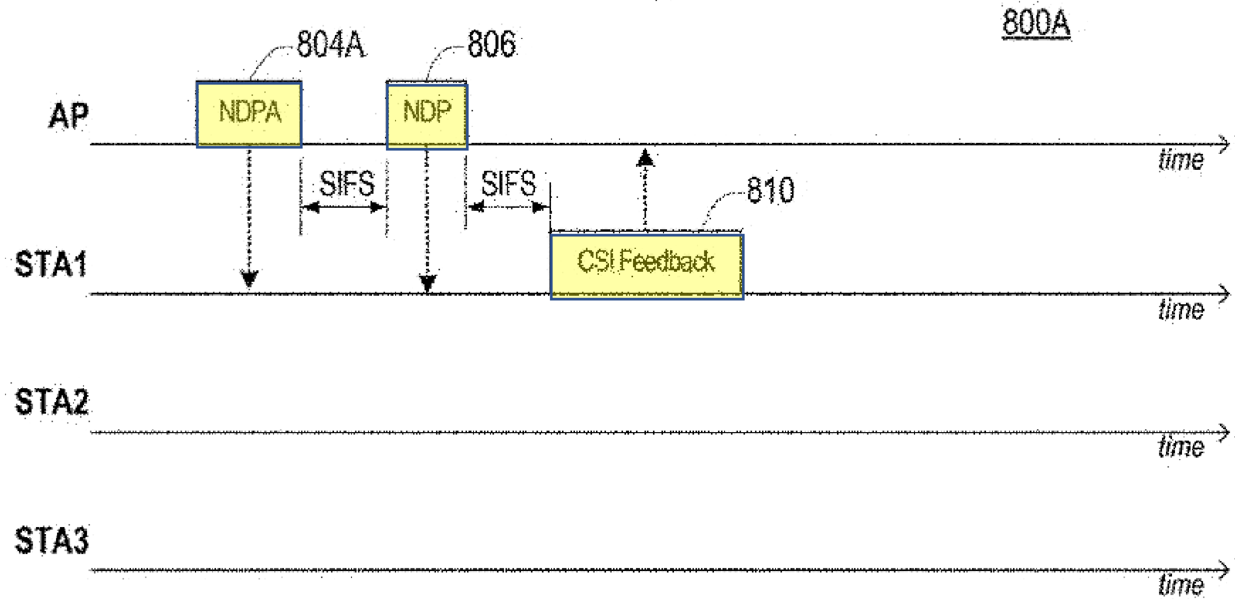
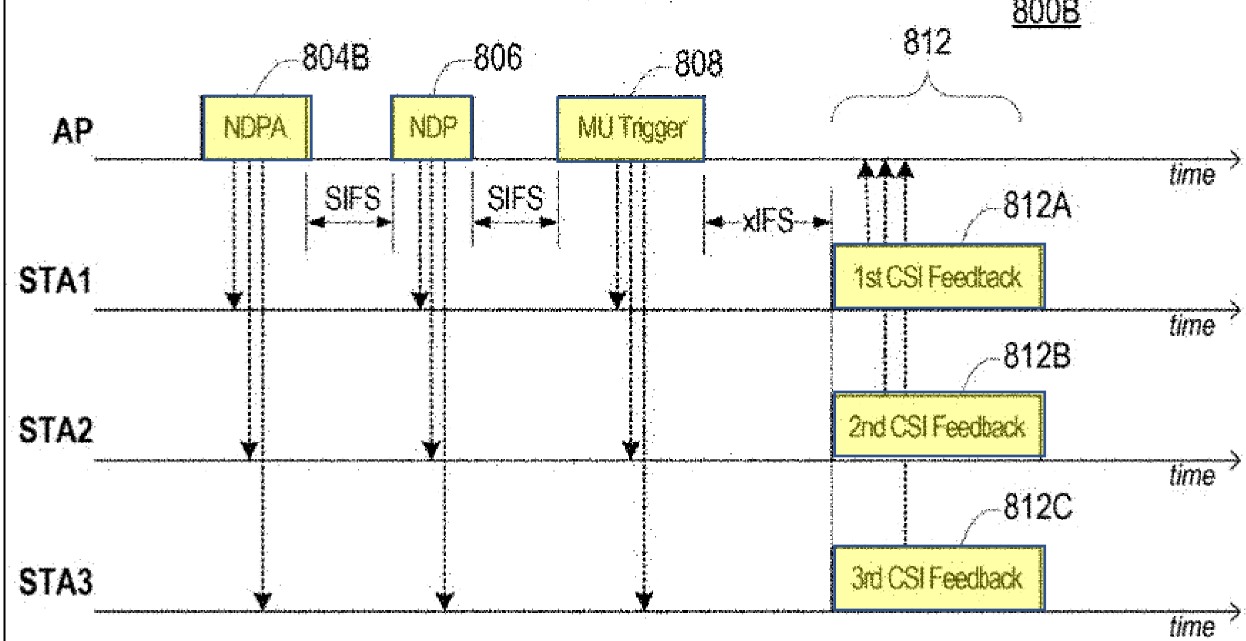


FIG. 8B



’919 at Figs. 8A, 8B (highlighting added).

1771. One aspect of the invention of the ’919 Patent is the ability to automatically use either an SU feedback method or an MU feedback method based on the number of station information (or “STA info”) fields that are included in the NDPA.

[redacted]

1772. Both methods begin with the transmission and reception of a Null Data Packet Announcement ("NDPA") followed by the transmission and reception of a Null Data Packet ("NDP"). '919 at 18:60-63, 19:12-17. When the NDPA is directed to only one station and has only one STA info field, the station transmits (or the AP receives) feedback in response to the NDP. *Id.* at 18:63-19:10. Alternatively, when the NDPA is directed to more than one station and includes multiple STA info fields, the AP sends a trigger frame, after which the stations send their feedback. *Id.* at 19:16-47.

1773. Whether the NDPA is directed to one station or several stations is indicated by the number of station information fields within the NDPA. *Id.* at 18:52-55. Specifically, it is indicated by the total number of station information fields in the NDPA. *Id.*

1774. The '919 Patent has two independent claims that recite similar subject matter. Both Claims 1 and 11 recite methods performed by a wireless device. Claim 1 and its dependent claims are drafted from the perspective of a station, while independent claim 11 and its dependent claims are drafted from the perspective of an access point. In Claim 1, the station determines exactly the cardinality of the station information fields, i.e., the total number of station information fields. *Id.*, 33:1-2, 8-10. If the number is one, the station will send feedback following the NDP. *Id.*, 33:4-7. Claim 1 does not limit the action taken by the station if there is more than one station information field, but Claims 2 and 8 add that when the number is greater than one, feedback is sent after receiving a trigger frame. *Id.*, 33:11-44. Claim 11 and its dependent claims describe a similar process from the perspective of an AP. *Id.*, 33:54-34:54.

[**1.Pre**]. A method performed by a wireless device, the method comprising:

> [**1.A**] receiving a Null Data Packet Announcement (NDPA), the NDPA including one or more station information fields;
>
> [**1.B**] determining exactly a number of the one or more station information fields in the NDPA;
>
> [**1.C**] receiving a Null Data Packet (NDP); and

[redacted]

[**1.D**] in response to determining that the number of the one or more station information fields in the NDPA is one, transmitting first Channel State Information (CSI) feedback in response to receiving the NDP,

[**1.E**] wherein the number of the one or more station information fields in the NDPA is the cardinality of the one or more station information fields in the NDPA.

[**11.Pre**] A method performed by a wireless device, the method comprising:

[**11.A**] transmitting a Null Data Packet Announcement (NDPA), the NDPA including one or more station information fields;

[**11.B**] transmitting a Null Data Packet (NDP); and

[**11.C**] when a number of the one or more station information fields in the NDPA is one, receiving first Channel State Information (CSI) feedback transmitted in response to the NDP[A] having only one station information field,

[**11.D**] wherein the number of the one or more station information fields in the NDPA is exactly the cardinality of the one or more station information fields in the NDPA.

1775. Dr. Hansen provides a summary of the asserted claims of the '919 Patent, which I generally agree with. Hansen Report at ¶414. However, I disagree with his conclusion that "the claimed methods of the '919 Patent were previously known in the art." *Id.*

14.2 '919 Prosecution History

1776. The '919 Patent is a continuation of application No. 15/291,947 (now U.S. Patent No. 9,667,394). Thus, the prosecution histories of both that '394 (parent) Patent and the '919 Patent are relevant.

14.2.1 The '947 Prosecution

1777. On October 12, 2016, the Applicant filed the '947 application with 20 initial claims. ATLAS-00019416-479.

1778. On January 25, 2017, the Examiner allowed the claims. ATLAS-00019509-513. The Examiner's remarks included amendments to the claims that the Applicant gave permission for in a January 4, 2016 interview. ATLAS-00019514-518. In the remarks, the Examiner considered the claims of the '947 application in view of Hedayat et al. (US 2012/0147804 A1) and Fischer et al. (US 2010/0309871 A1). ATLAS-00019515-517.

[redacted]

1779. On February 28, 2017, the Applicant disclosed an international search report from a related PCT application. ATLAS-00019531-534, 537. Per the search report, most of the claims were obvious in view of U.S. published patent applications 2014/0029543 A1 to Broadcom and 2009/0136034 A1 to Gaal, and some claims were obvious in further view of U.S. published patent applications 2014/0334476 A1 to ETRI. ATLAS-00019548-552. The Examiner considered the disclosure on March 7, 2017. ATLAS-00019553-554.

1780. The ’394 Patent issued on May 30, 2017.

14.2.2 The ’094 Prosecution

1781. On April 25, 2017, the Applicant filed the ’094 application with 20 initial claims. ATLAS-00019012-096.

1782. On July 31, 2017, the Examiner rejected pending claims 1-5, 9, 11-15, and 19 as obvious in view of Stephens (US 2014/0044112 A1) and Abraham (US 2012-0250543 A1). ATLAS-00019100-101. The Examiner also rejected claims 6-8 and 16-18 as obvious in view of Stephens, Abraham, and further in view of Merlin (US 2016/0262051 A1). ATLAS-00019104-105. The Examiner also rejected claims 10 and 20 as obvious in view of Stephens, Abraham, and further in view of Seok (US 2015/0085777 A1). ATLAS-00019106.

1783. On September 6, 2017, the Application and the Examiner had a telephonic interview to discuss the pending claims and the outstanding rejection, as well as a proposed claim amendment. ATLAS-00019155.

1784. On October 11, 2017, the Applicant Amended to claims as follows:

1. (Currently amended) A method performed by a wireless device, the method comprising:

receiving a Null Data Packet Announcement (NDPA), the NDPA including one or more station information fields;

determining a number of the one or more station information fields in the NDPA;

receiving a Null Data Packet (NDP); and

when the number of the one or more station information fields in the NDPA is one, transmitting first Channel State Information (CSI) feedback in response to receiving the NDP,

wherein the number of the one or more station information fields in the NDPA is the cardinality of the one or more station information fields in the NDPA.

[redacted]

> 11. (Currently amended) A method performed by a wireless device, the method comprising:
>
> transmitting a Null Data Packet Announcement (NDPA), the NDPA including one or more station information fields;
>
> transmitting a Null Data Packet (NDP); and
>
> when a number of the one or more station information fields in the NDPA is one, receiving first Channel State Information (CSI) feedback in response to transmitting the NDP,
>
> wherein the number of the one or more station information fields in the NDPA is the cardinality of the one or more station information fields in the NDPA.

ATLAS-00019158-160 (highlighting added). The applicant argued that the prior art did not disclose or suggest all the features of the claims, emphasizing the highlighted claim language above. ATLAS-00019162.

1785. On December 7, 2017, The Examiner rejected pending claims 1 and 11 under 35 U.S.C. § 112(a). ATLAS-00019168-169. The Examiner also rejected claims 1-3, 5-8, 10-13, 15-18, and 20 as obvious in view of Wu (US 2015/0372795 A1) and Merlin (US 2016/0262051 A1). ATLAS-00019170. The Examiner also rejected claims 4 and 14 as obvious in view of Wu and Merlin and further in view of Abraham et al. (US 2012/0250543 A1). ATLAS-00019174. The Examiner also rejected claims 9 and 19 as obvious in view of Wu and Merlin and further in view of Stephens et al. (US 2014/0044112 A1). ATLAS-00019175.

1786. On January 9, 2018, the Application and the Examiner had a telephonic interview to discuss the pending claims and the outstanding rejection, as well as a proposed claim amendment. ATLAS-00019206

1787. On January 25, 2018, the Applicant amended the claims as follows:

[redacted]

1. (Currently amended) A method performed by a wireless device, the method comprising:

receiving a Null Data Packet Announcement (NDPA), the NDPA including one or more station information fields;

determining exactly a number of the one or more station information fields in the NDPA;

receiving a Null Data Packet (NDP); and

~~when~~ in response to determining that the number of the one or more station information fields in the NDPA is one, transmitting first Channel State Information (CSI) feedback in response to receiving the NDP,

wherein the number of the one or more station information fields in the NDPA is the cardinality of the one or more station information fields in the NDPA.

11. (Currently amended) A method performed by a wireless device, the method comprising:

transmitting a Null Data Packet Announcement (NDPA), the NDPA including one or more station information fields;

transmitting a Null Data Packet (NDP); and

when a number of the one or more station information fields in the NDPA is one, receiving first Channel State Information (CSI) feedback transmitted in response to ~~transmitting~~ the NDP having only one station information field,

wherein the number of the one or more station information fields in the NDPA is exactly the cardinality of the one or more station information fields in the NDPA.

ATLAS-00019209-211 (highlighting added). The applicant argued that the prior art did not disclose or suggest all the features of the claims, emphasizing the highlighted claim language above. ATLAS-00019213. Henceforth, on March 14, 2018, the Examiner allowed the claims. ATLAS-00019220-228. The '919 Patent issued on July 10, 2018.

1788. Dr. Hansen provides a summary of the '919 prosecution history, which I mostly agree with. Hansen Report at ¶142. However, Dr. Hansen mischaracterizes the applicants arguments in the January 25, 2018 Amendment after Non-Final Rejection. Dr. Hansen contends that with respect to claim 11, the applicant "noted that the CSI feedback is transmitted in response to the NDP "having only one station information field." Hansen at ¶142. The Applicant did not discuss "that the first Channel State Information (CSI)

[redacted]

feedback is sent 'in response to determining that the number of the one or more station information fields in the NDPA is one'" in its remarks. Hansen Report at ¶142. Instead, the applicant argued that "with the incorporation of the term 'exactly' into claims 1 and 11 (as suggested by the Examiner) and with the other amendments presented herein, the Examiner acknowledged that claims 1 and 11 as currently amended are patentably distinct from the combination of Wu and Merlin relied on in the Final Office Action." ATLAS-00019213. And, as I explain below in Section 16 and incorporate here, there is an error in claim 11 that should what stated, "in response to the NDPA having only one station information field."

14.3 Priority Date

1789. The '919 Patent is a continuation of application No. 15/291,947, claims priority to provisional application No. 15/291,947 filed on October 12, 2016 (the "'947 Application"), U.S. Patent No. 9,667,394, and claims priority to provisional application No. 62/240,419, filed on October 12, 2015 (the "'419 Provisional"), provisional application No. 62/333,077, filed on May 6, 2016 (the "'077 Provisional"), provisional application No. 62/33,192, filed on May 7, 2016 (the "'192 Provisional"), and provisional application No. 62/331,380, filed on May 3, 2016 (the "'380 Provisional").

Related U.S. Application Data

(63) Continuation of application No. 15/291,947, filed on Oct. 12, 2016, now Pat. No. 9,667,394.

(Continued)

Related U.S. Application Data

(60) Provisional application No. 62/333,192, filed on May 7, 2016, provisional application No. 62/333,077, filed on May 6, 2016, provisional application No. 62/331,380, filed on May 3, 2016, provisional application No. 62/240,419, filed on Oct. 12, 2015.

ATLAS-00018965-966.

[redacted]

14.3.1 The '419 Provisional

1790. The '419 Provisional (ATLAS-00019278-304) is titled "Method of Channel State Information Feedback for 802.11ax." It relates to sound procedure and explains that "[o]nly having a single sounding procedure may result in [an] inefficient sounding process" and explains that "[t]he goal [is] to allow various sounding procedures that support[] various feedback situations." ATLAS-00019282. Importantly, it teaches a sounding method where "depending on [the] number of per-STA information [fields] in the NDPA," one of two procedures are used. ATLAS-00019290. "If the NDPA frame contains only 1 STA information [field], the STA assumes the CSI feedback needs to be sent immediately (with [a] SIFS interval) after reception of [the] NDPA." *Id.* "If the NDPA frame contains more than 1 STA information [field] (i.e. 2 or more), the STA assumes that CSI feedback needs to be sent immediately (with [an] xIFS interval) after reception of [an] MU trigger frame." *Id.* These procedures are illustrated in Figures 1 and 2 of the provisional:

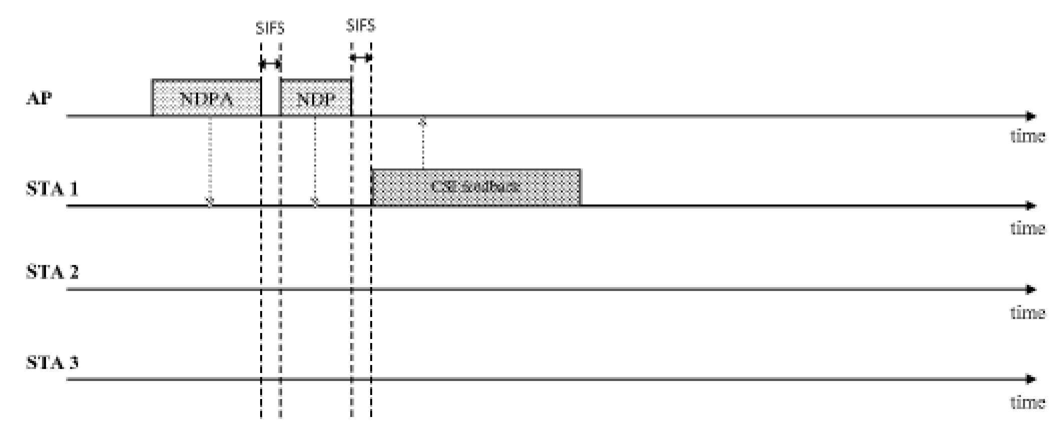


Figure 1

[redacted]

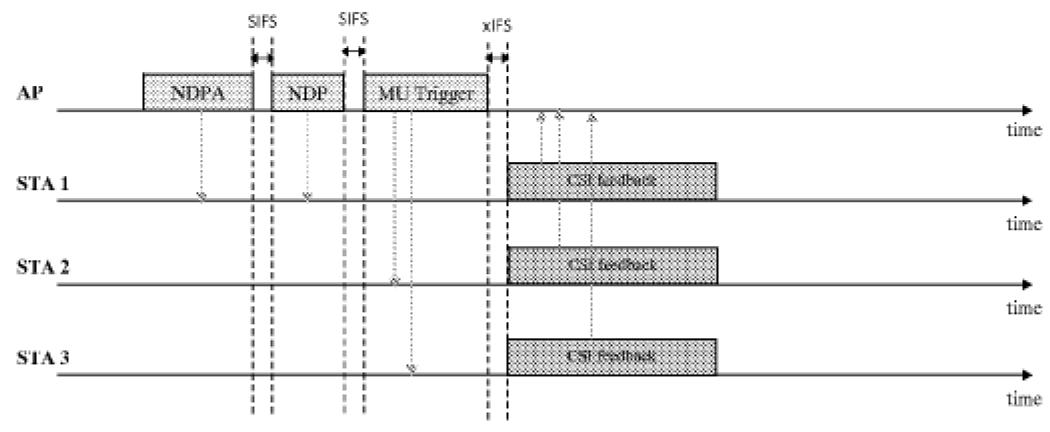


Figure 2

1791. The ’419 Provisional also teaches that multiple trigger frames or sounding polls may be used to solicit subsequent feedback. ATLAS-00019291-292.

14.3.2 The ’077 Provisional

1792. The ’077 Provisional (ATLAS-00019338-372) is titled “Protection mechanisms for wireless transmission in a shared channel.” It relates to simultaneous downlink multi user request-to-send (“RTS”) frame transmissions that solicit multi user clear-to-send (“CTS”) frame responses. ATLAS-00019347. Importantly, it teaches that trigger frames may include UL MU scheduling information ATLAS-00019356-357.

14.3.3 The ’192 Provisional

1793. The ’077 Provisional (ATLAS-00019373-403) is titled “Method of Generating Scrambling Sequence for RF Combined Frames.” It relates to scrambling sequences for multi user transmissions. ATLAS-00019393-399.

14.3.4 The ’380 Provisional

1794. The ’380 Provisional (ATLAS-00019305-337) is titled “Protection mechanisms for wireless transmission in a shared channel.” It relates to simultaneous transmissions of RTS frame using downlink multi user methods that solicit multi user CTS frames from multiple stations. ATLAS-00019317. Importantly, it teaches that trigger frames may solicit uplink multi user transmissions and include UL MU scheduling information ATLAS-00019325-328.

[redacted]

14.3.5 The ’419 Provisional Fully Supports ’919 Claim 1[PRE], 11[PRE]

1795. The preamble of ’919 Claims 1 and 18 both cover “[a] method performed by a wireless device.”

1796. The ’419 provisional fully discloses a method performed by a wireless device, for example:

INVENTION DISCLOSURE FORM

1. TITLE OF THE INVENTION:

METHOD OF CHANNEL STATE INFORMATION FEEDBACK FOR 802.11AX

2. INVENTORS:

- *LEE, Dae Won; Irvine, California*
- *NOH, Yujin; Irvine, California*
- *MOON, Sungho; Irvine, California*
- *HEDAYAT, Ahmad Reza; Aliso Viejo, California*

3. TECHNICAL PROBLEM TO BE SOLVED/CURRENT SOLUTION:

Efficient sounding procedure may depend on how many STAs are participating in the sounding procedure as well as available STAs for uplink multi-user transmission. Only having a single sounding procedure may result in inefficient sounding process. The goal to allow various sounding procedures that supports various feedback situations.

ATLAS-00019282

In a wireless local area network (WLAN), a basic service set (BSS) includes a plurality of WLAN devices. Each of the WLAN devices may include a medium access control (MAC) layer and a physical (PHY) layer according to one or more IEEE (Institute of Electrical and Electronics Engineers) 802.11 standards. In the plurality of WLAN devices, at least one WLAN device may be an access point (AP) station and the other WLAN devices may be non-AP stations (non-AP STAs). Alternatively, all of the plurality of WLAN devices may be non-AP STAs in an ad-hoc networking environment. In general, the AP STA and the non-AP STA may be each referred to as a STA or may be collectively referred to as STAs. However, for ease of description herein, only the non-AP STAs are referred to herein as the STAs.

Id.

[redacted]

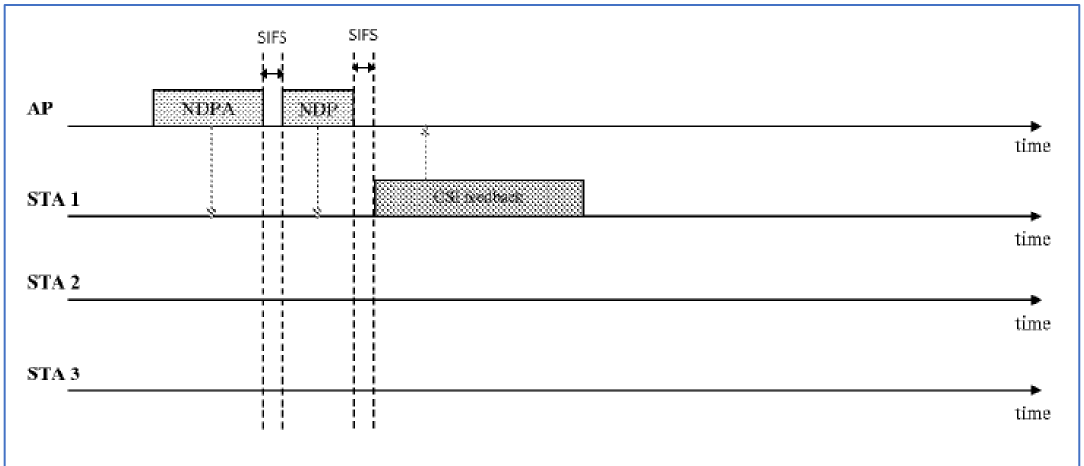


Figure 1

ATLAS-00019290

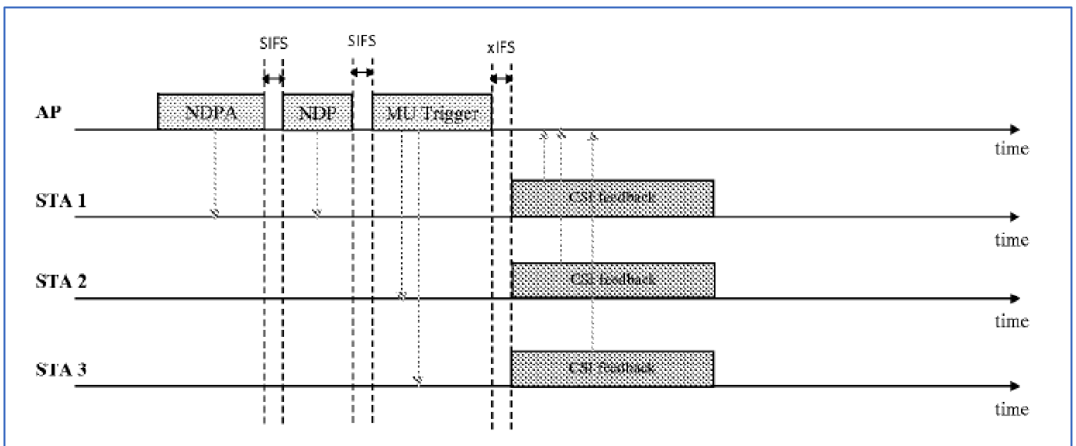


Figure 2

ATLAS-00019290

14.3.6 The '419 Provisional Fully Supports '919 Claim 1[A], 11[A]

1797. Limitation A of '919 claim 1 recites: "receiving a Null Data Packet Announcement (NDPA), the NDPA including one or more station information fields." Similarly, limitation A of '919 claim 11 recites: "transmitting a Null Data Packet Announcement (NDPA), the NDPA including one or more station information fields."

1798. The '419 provisional fully discloses transmitting and receiving NDPA frames, for example:

[redacted]

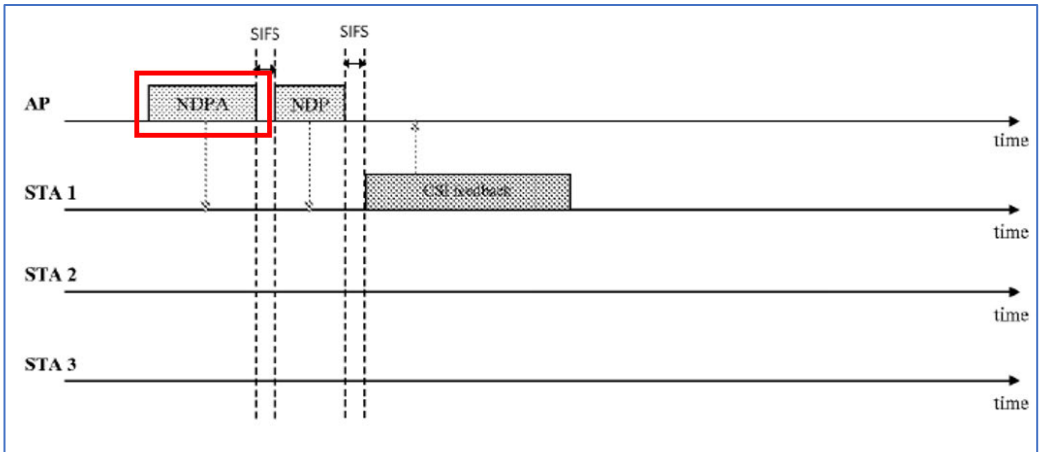


Figure 1

ATLAS-00019290

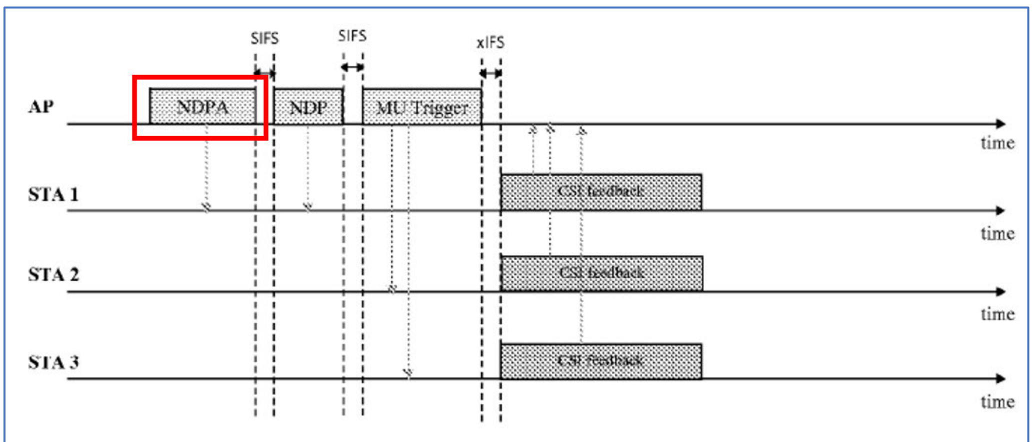


Figure 2

ATLAS-00019290

1799. The ’419 provisional fully discloses that the NDPA frames included one or more station information fields, for example:

[redacted]

Method of sounding procedure type indication – Option 1)

In this option, two sounding procedures depending on number of per-STA information in the NDPA frame. The two sounding procedures are shown in Figure 1 and 2. The NDPA frame contains parameters for CSI feedback as well as list of STAs that needs to participate in the CSI feedback process.

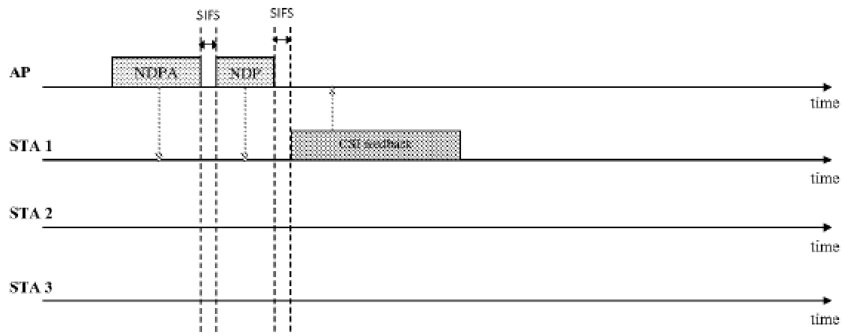


Figure 1

If the NDPA frame contains only 1 STA information, the STA assumes that CSI feedback needs to be sent immediately (with SIFS interval) after reception of NDP. The procedure is shown in Figure 1.

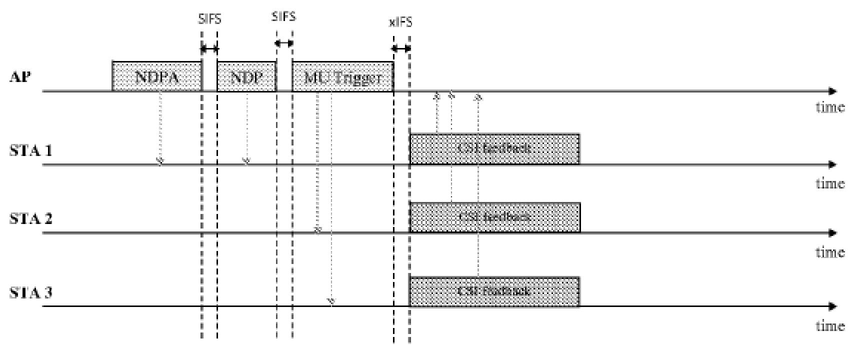


Figure 2

If the NDPA frame contains more than 1 STA information (i.e. 2 or more), the STA assumes that CSI feedback needs to be sent immediately (with xIFS interval) after reception of MU trigger frame. Therefore, all STAs participating the sounding feedback process will simply compute the CSI from the NDP and wait for the MU trigger frame (or possibility a sounding poll frame) to transmit the computed CSI. The procedure is shown in Figure 2. It is also possible to have sounding poll frame instead of the MU trigger frame, but this results in a single user transmission from the chosen STA indicated in the sounding poll frame.

ATLAS-00019290

14.3.7 The ’419 Provisional Fully Supports ’919 Claim 1[B]

1800. Limitation B of ’919 claim 1 recites: “determining exactly a number of the one or more station information fields in the NDPA.”

1801. The ’419 provisional fully discloses determining exactly a number of the one or more station information fields in the NDPA, for example:

[redacted]

> If the NDPA frame contains only 1 STA information, the STA assumes that CSI feedback needs to be sent immediately (with SIFS interval) after reception of NDP. The procedure is shown in Figure 1.

ATLAS-00019290

> If the NDPA frame contains more than 1 STA information (i.e. 2 or more), the STA assumes that CSI feedback needs to be sent immediately (with xIFS interval) after reception of MU trigger frame. Therefore, all STAs participating the sounding feedback process will simply compute the CSI from the NDP and wait for the MU trigger frame (or possibility a sounding poll frame) to transmit the computed CSI. The procedure is shown in Figure 2. It is also possible to have sounding poll frame instead of the MU trigger frame, but this results in a single user transmission from the chosen STA indicated in the sounding poll frame.

ATLAS-00019290

1802. In these disclosures, the '419 provisional describes that the method includes determining exactly the total number of station information fields. For example, the '419 provisional explains that there can be exactly one station information field, exactly 2 station information fields, or more than that. *Id.* This is illustrated in Figures 1 and 2:

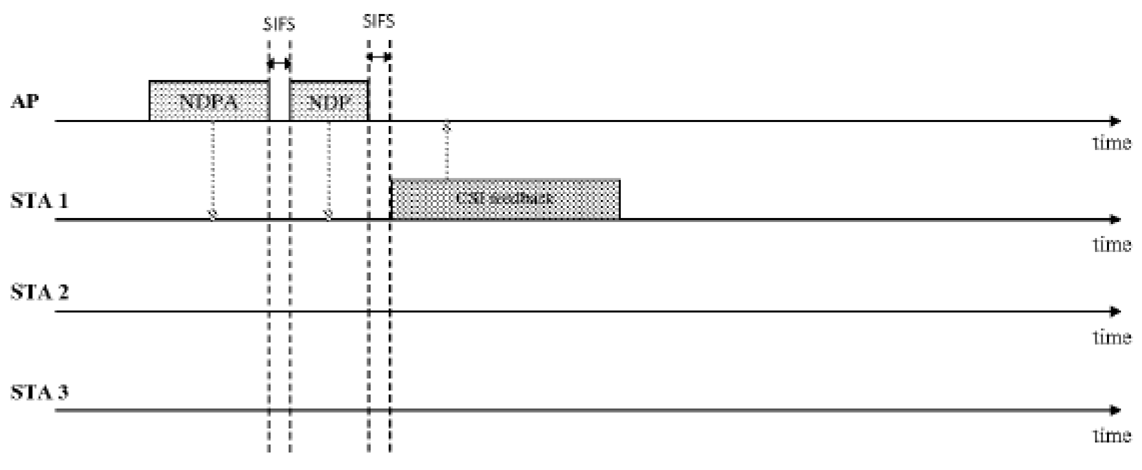


Figure 1

[redacted]

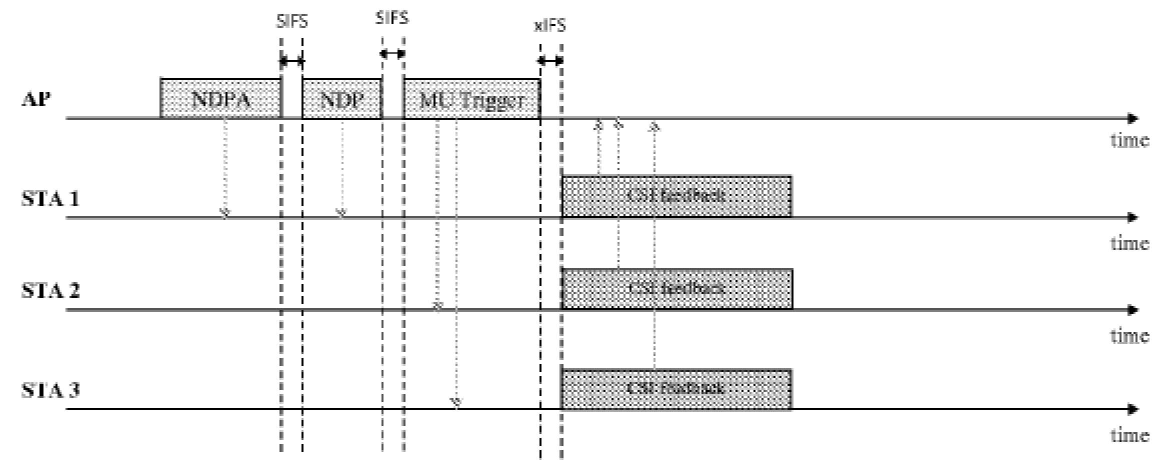


Figure 2

ATLAS-00019290

1803. As seen above, Figure 1 shows feedback from a single station. In this embodiment, an AP transmits an NDPA designating only a single station, STA1. After an Inter-Frame Space ("IFS"), the AP then transmits an NDP. The station receives the NDPA and determines that it indicates only a single station. Thus, the station necessarily determines an exact number of stations, in this case exactly one. Accordingly, the station receives the NDP, uses it to compute CSI feedback, and sends the feedback without awaiting a trigger frame.

1804. In the alternative, Figure 2 illustrates a multi-user feedback technique. In this embodiment, an AP transmits an NDPA designating multiple stations, STA1, STA2, and STA3. The stations receive the NDPA and determine that it indicates a plurality of stations, *e.g.*, by counting exactly the number of station information fields in the NDPA. When that exact count shows there is more than one station, the stations determine that they are operating under this second sounding procedure. Accordingly, the stations receive a NDP, use it to compute CSI feedback, and wait for an MU Trigger frame. After the NDP and IFS, the AP sends a trigger frame that indicates to the station which resources the stations will use to provide the CSI feedback. In response to this trigger frame, the stations simultaneously transmit their CSI feedback after a inter-frame space.

[redacted]

14.3.8 The ’419 Provisional Fully Supports ’919 Claim 1[C], 11[B]

1805. Limitation C of ’919 claim 1 recites: “receiving a Null Data Packet (NDP).” Similarly, limitation B of ’919 claim 11 recites: “transmitting a Null Data Packet (NDP).”

1806. The ’419 provisional fully discloses transmitting and receiving an NDP, for example:

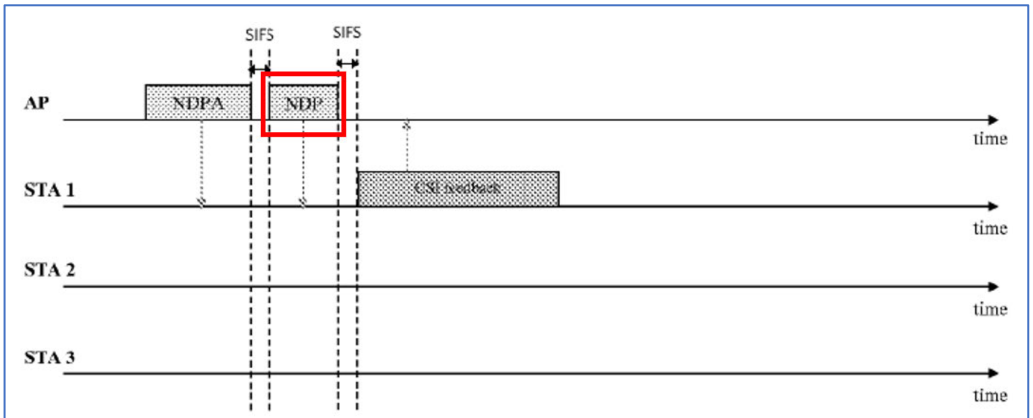


Figure 1

ATLAS-00019290

If the NDPA frame contains only 1 STA information, the STA assumes that CSI feedback needs to be sent immediately (with SIFS interval) after reception of NDP. The procedure is shown in Figure 1.

ATLAS-00019290

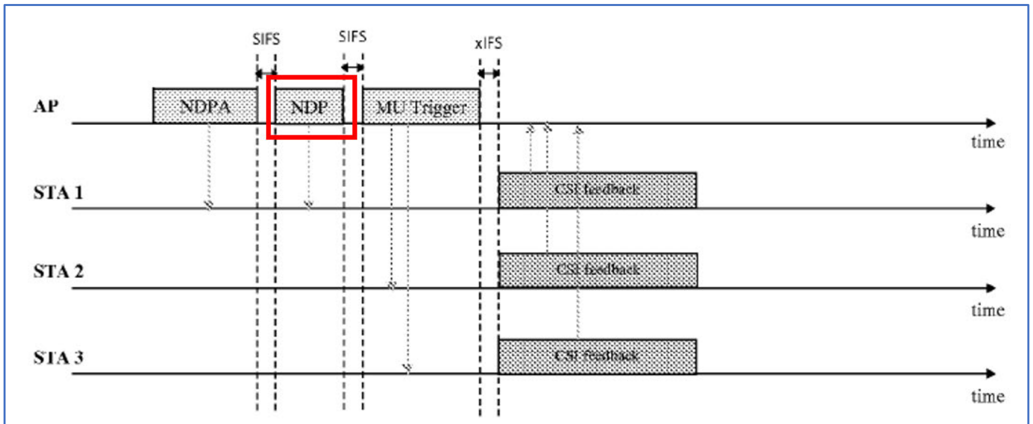


Figure 2

ATLAS-00019290

[redacted]

14.3.9 The '419 Provisional Fully Supports '919 Claim 1[D], 11[C]

1807. Limitation D of '919 claim 1 recites: "in response to determining that the number of the one or more station information fields in the NDPA is one, transmitting first Channel State Information (CSI) feedback in response to receiving the NDP." Similarly, limitation C of '919 claim 11 recites: "when a number of the one or more station information fields in the NDPA is one, receiving first Channel State Information (CSI) feedback transmitted in response to the NDP[A] having only one station information field."

1808. The '419 provisional fully discloses determining the number of station information fields in the NDPA, for example:

If the NDPA frame contains only 1 STA information, the STA assumes that CSI feedback needs to be sent immediately (with SIFS interval) after reception of NDP. The procedure is shown in Figure 1.

ATLAS-00019290

If the NDPA frame contains more than 1 STA information (i.e. 2 or more), the STA assumes that CSI feedback needs to be sent immediately (with xIFS interval) after reception of MU trigger frame. Therefore, all STAs participating the sounding feedback process will simply compute the CSI from the NDP and wait for the MU trigger frame (or possibility a sounding poll frame) to transmit the computed CSI. The procedure is shown in Figure 2. It is also possible to have sounding poll frame instead of the MU trigger frame, but this results in a single user transmission from the chosen STA indicated in the sounding poll frame.

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1809. The '419 provisional fully discloses transmitting channel station information feedback when there is only one station information field in response to receiving the NDP, for example:

[redacted]

In this option, two sounding procedures depending on number of per-STA information in the NDPA frame. The two sounding procedures are shown in Figure 1 and 2. The NDPA frame contains parameters for CSI feedback as well as list of STAs that needs to participate in the CSI feedback process.

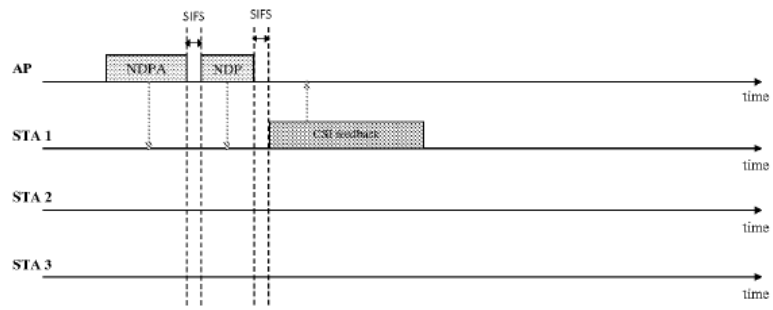

Figure 1

If the NDPA frame contains only 1 STA information, the STA assumes that CSI feedback needs to be sent immediately (with SIFS interval) after reception of NDP. The procedure is shown in Figure 1.

ATLAS-00019290

14.3.10The ’419 Provisional Fully Supports ’919 Claim 1[E], 11[D]

1810. Limitation E of ’919 claim 1 recites: “wherein the number of the one or more station information fields in the NDPA is the cardinality of the one or more station information fields in the NDPA.” Similarly, limitation D of ’919 claim 11 recites: “wherein the number of the one or more station information fields in the NDPA is exactly the cardinality of the one or more station information fields in the NDPA.”

1811. As an initial matter, “cardinality” is a common term in mathematics meaning “the number of elements in a set.” *See* ATLAS-00019155. A person of skill in the art would understand this meaning without the need to rely on intrinsic or extrinsic evidence. Thus, the ’419 provisional fully discloses “wherein the number of the one or more station information fields in the NDPA is the cardinality of the one or more station information fields in the NDPA,” for example, and as illustrated by my discussion above regarding “determining exactly a number of the one or more station information fields in the NDPA,” which I incorporate here:

If the NDPA frame contains only 1 STA information, the STA assumes that CSI feedback needs to be sent immediately (with SIFS interval) after reception of NDP. The procedure is shown in Figure 1.

ATLAS-00019290

[redacted]

> If the NDPA frame contains more than 1 STA information (i.e. 2 or more), the STA assumes that CSI feedback needs to be sent immediately (with xIFS interval) after reception of MU trigger frame. Therefore, all STAs participating the sounding feedback process will simply compute the CSI from the NDP and wait for the MU trigger frame (or possibility a sounding poll frame) to transmit the computed CSI. The procedure is shown in Figure 2. It is also possible to have sounding poll frame instead of the MU trigger frame, but this results in a single user transmission from the chosen STA indicated in the sounding poll frame.

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1812. In these disclosures, the '419 provisional describes that the method includes determining exactly the total number of station information fields, *i.e.* the cardinality of the station information fields. For example, the '419 provisional explains that there can be exactly one station information field (meaning the cardinality is 1), exactly 2 station information fields (meaning the cardinality is 2), or more than that (meaning the cardinality is the total number of fields). *Id.* This is illustrated in Figures 1 and 2:

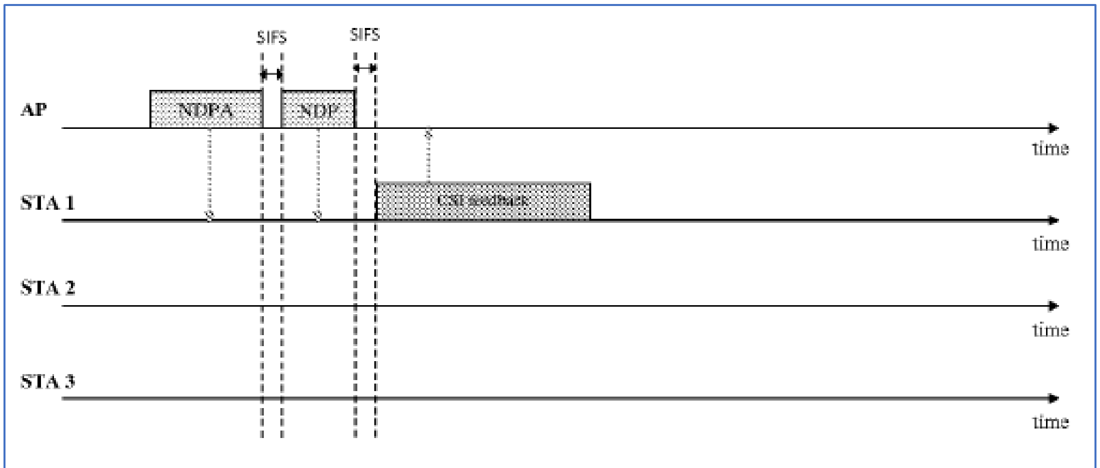


Figure 1

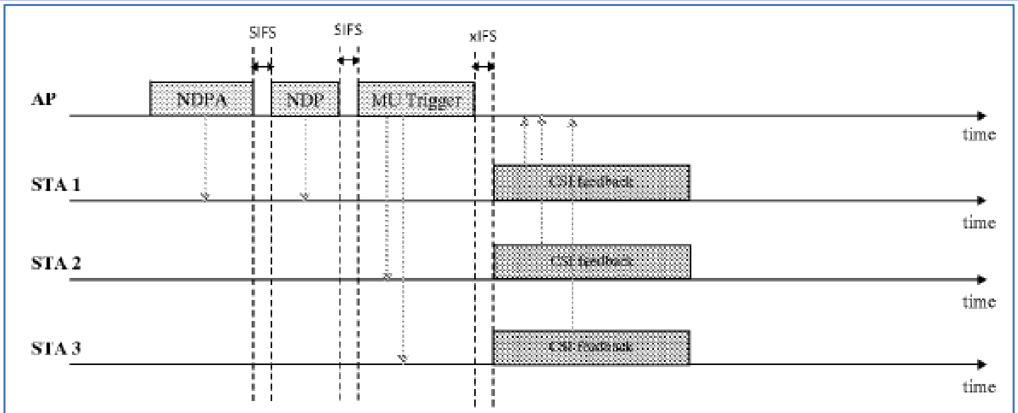


Figure 2

[redacted]

ATLAS-00019290

1813. As seen above, Figure 1 shows feedback from a single station. In this embodiment, an AP transmits an NDPA designating only a single station, STA1. After an Inter-Frame Space ("IFS"), the AP then transmits an NDP. The station receives the NDPA and determines that it indicates only a single station. Thus, the station necessarily determines the cardinality of the station information fields, in this case, one. Accordingly, the station receives the NDP, uses it to compute CSI feedback, and sends the feedback without awaiting a trigger frame.

1814. In the alternative, Figure 2 illustrates a multi-user feedback technique. In this embodiment, an AP transmits an NDPA designating multiple stations, STA1, STA2, and STA3. The stations receive the NDPA and determine that it indicates a plurality of stations, *e.g.*, by counting exactly the number of station information fields in the NDPA and thereby determining the cardinality. When that cardinality shows there is more than one station, the stations determine that they are operating under this second sounding procedure. Accordingly, the stations receive a NDP, use it to compute CSI feedback, and wait for an MU Trigger frame. After the NDP and IFS, the AP sends a trigger frame that indicates to the station which resources the stations will use to provide the CSI feedback. In response to this trigger frame, the stations simultaneously transmit their CSI feedback after a inter-frame space.

14.3.11The '419 Provisional Fully Supports '919 Claim 2, 12

1815. Claim 2 of '919 recites: "The method of claim 1, further comprising: when the number of the one or more station information fields in the NDPA is greater than one: receiving a first trigger frame; and transmitting the first CSI feedback in response to receiving the first trigger frame." Similarly, claim 12 of '919 recites: "The method of claim 11, further comprising: when the number of the one or more station information fields in the NDPA is greater than one: transmitting a first trigger frame; and receiving the first CSI feedback in response to transmitting the first trigger frame."

[redacted]

1816. The ’419 provisional fully discloses when there is more than on station information field in the NDPA, receiving and transmitting a trigger frame and transmitting and receiving feedback in response to receiving and sending a trigger frame, for example:

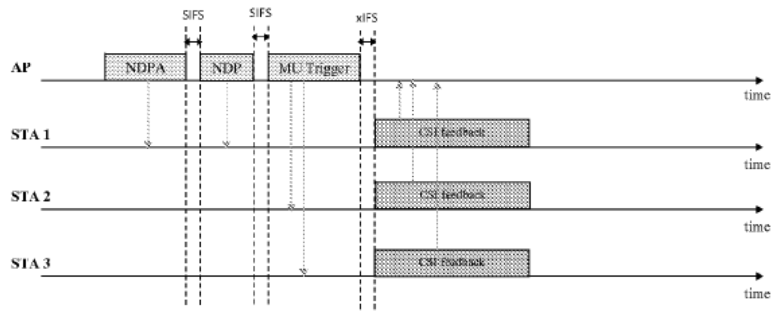


Figure 2

If the NDPA frame contains more than 1 STA information (i.e. 2 or more), the STA assumes that CSI feedback needs to be sent immediately (with xIFS interval) after reception of MU trigger frame. Therefore, all STAs participating the sounding feedback process will simply compute the CSI from the NDP and wait for the MU trigger frame (or possibility a sounding poll frame) to transmit the computed CSI. The procedure is shown in Figure 2. It is also possible to have sounding poll frame instead of the MU trigger frame, but this results in a single user transmission from the chosen STA indicated in the sounding poll frame.

ATLAS-00019290

14.3.12The ’419 Provisional Fully Supports ’919 Claim 3, 13

1817. Claim 3 of ’919 recites: “The method of claim 2, wherein transmitting the first CSI feedback in response to receiving the NDP comprises: transmitting the first CSI feedback a first predetermined interframe space (IFS) after receiving the NDP.” Similarly, claim 13 of ’919 recites: “The method of claim 12, wherein receiving the first CSI feedback in response to transmitting the NDP comprises: receiving the first CSI feedback a first predetermined interframe space (IFS) after transmitting the NDP.”

1818. The ’419 provisional fully discloses transmitting the feedback on interspace frame after receiving or transmitting the NDP, for example:

[redacted]

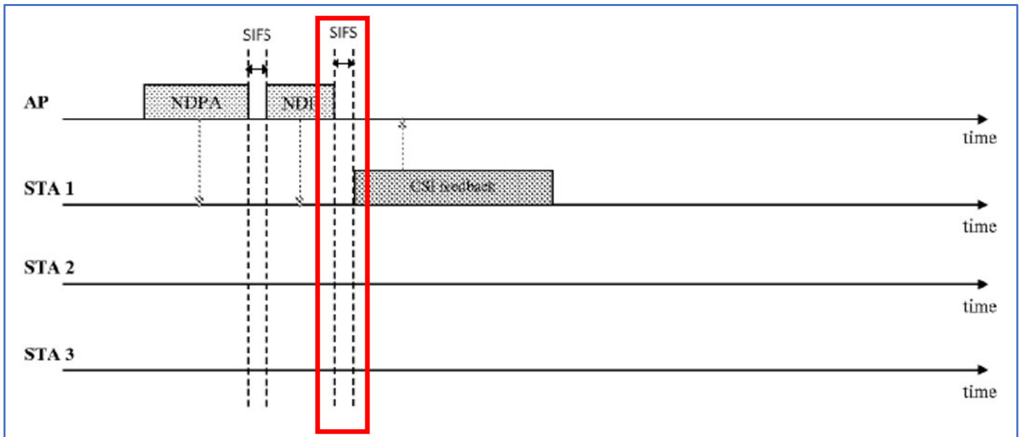


Figure 1

ATLAS-00019290

> If the NDPA frame contains only 1 STA information, the STA assumes that CSI feedback needs to be sent immediately (with SIFS interval) after reception of NDP. The procedure is shown in Figure 1.

ATLAS-00019290

14.3.13The '419 Provisional Fully Supports '919 Claim 4, 15

1819. Claim 4 of '919 recites: "The method of claim 2, wherein transmitting the first CSI feedback in response to receiving the NDP comprises: transmitting the first CSI feedback in a single user transmission in response to receiving the NDP." Similarly, claim 15 of '919 recites: "The method of claim 12, wherein receiving the first CSI feedback in response to transmitting the NDP comprises: receiving the first CSI feedback in a single user transmission in response to transmitting the NDP."

1820. The '419 provisional fully discloses transmitting or receiving feedback in a single user transmission when feedback is transmitted or received in response to receiving or transmitting an NDP, for example this is illustrated in figure 1 where feedback is only sent by one of the three STAs:

[redacted]

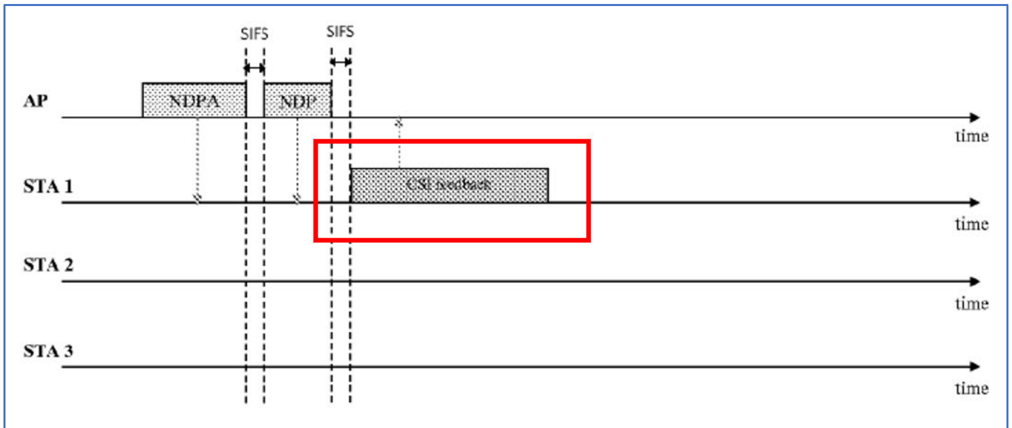


Figure 1

ATLAS-00019290

14.3.14The ’419 Provisional Fully Supports ’919 Claim 5, 16

1821. Claim 5 of ’919 recites: “The method of claim 4, wherein transmitting the first CSI feedback in response to receiving the first trigger frame comprises: transmitting the first CSI feedback in a multi user transmission in response to receiving the first trigger frame.” Similarly, claim 16 of ’919 recites: “The method of claim 15, wherein receiving the first CSI feedback in response to transmitting the first trigger frame comprises: receiving the first CSI feedback in a multi user transmission in response to transmitting the first trigger frame.”

1822. The ’419 provisional fully discloses transmitting or receiving feedback in a multi user transmission when feedback is transmitted or received in response to receiving or transmitting a trigger frame, for example this is illustrated in figure 2 where feedback is only sent by all three STAs simultaneously:

[redacted]

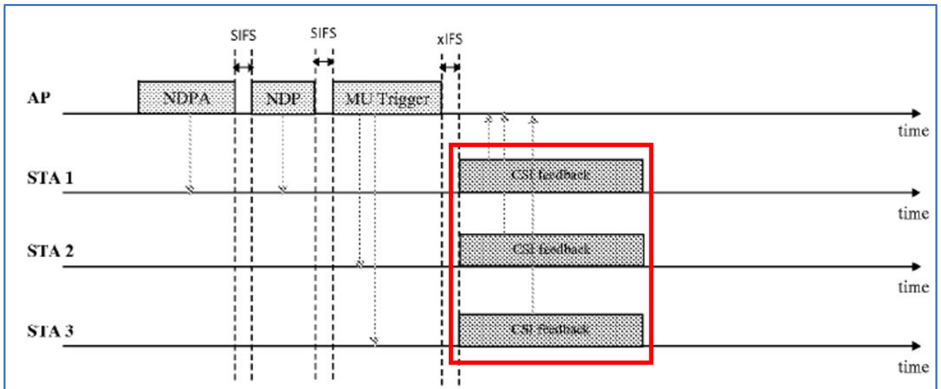


Figure 2

ATLAS-00019290

14.3.15The '419 Provisional Fully Supports '919 Claim 6, 17

1823. Claim 6 of '919 recites: "The method of claim 5, wherein the first trigger frame comprises resource assignment information." Similarly, claim 17 of '919 recites: "The method of claim 16, wherein the first trigger frame comprises resource assignment information."

1824. The '419 provisional fully discloses that the trigger frame includes resource assignment information, for example:

> Channel state information (CSI) feedback procedure, also known as sounding procedure, consist of transmission of non-data packet announcement (NDPA) transmission followed by non-data packet (NDP) by the beamformer (i.e. Tx node) and transmission of the CSI feedback by the beamformee after NDPA and NPD transmission. In order to reduce overall sounding overhead, the CSI feedback by multiple beamformee can send the feedback packets at the same time in uplink OFDMA and/or MU-MIMO transmission. The uplink OFDMA and/or MU-MIMO transmissions, denoted as multi-user (MU) transmission, will be sent after reception of a trigger frame that facilitate resource assignment among users such that transmissions do not overlap in frequency and/or spatial domain.

ATLAS-00019289

14.3.16The '419 Provisional Fully Supports '919 Claim 7, 18

1825. Claim 7 of '919 recites: "The method of claim 6, wherein transmitting the first CSI feedback in a multi user transmission comprises: participating in the multi user transmission based on the resource assignment information to transmit the first CSI feedback in response to receiving the first trigger frame." Similarly, claim 18 of '919 recites: "The method of claim 17, wherein receiving the first CSI feedback in a multi user

[redacted]

transmission comprises: participating in the multi user transmission based on the resource assignment information to receive the first CSI feedback in response to transmitting the first trigger frame."

1826. The '419 provisional fully discloses participating in multi user transmission based on the resource assignment information to receive the feedback in response to the trigger frame, for example:

Channel state information (CSI) feedback procedure, also known as sounding procedure, consist of transmission of non-data packet announcement (NDPA) transmission followed by non-data packet (NDP) by the beamformer (i.e. Tx node) and transmission of the CSI feedback by the beamformee after NDPA and NPD transmission. In order to reduce overall sounding overhead, the CSI feedback by multiple beamformee can send the feedback packets at the same time in uplink OFDMA and/or MU-MIMO transmission. The uplink OFDMA and/or MU-MIMO transmissions, denoted as multi-user (MU) transmission, will be sent after reception of a trigger frame that facilitate resource assignment among users such that transmissions do not overlap in frequency and/or spatial domain.

ATLAS-00019289

14.3.17The '419 Provisional Fully Supports '919 Claim 8, 19

1827. Claim 8 of '919 recites: "The method of claim 2, further comprising: when the number of one or more station information fields in the NDPA is greater than one: receiving a second trigger frame; and transmitting second CSI feedback in response to receiving the second trigger frame." Similarly, claim 19 of '919 recites: "The method of claim 12, further comprising: when the number of one or more station information fields in the NDPA is greater than one: transmitting a second trigger frame; and receiving second CSI feedback in response to transmitting the second trigger frame."

1828. The '419 provisional fully discloses receiving or transmitting at second trigger frame when there is more than one station information field in the NDPA and receiving or transmitting second feedback information in response to the second trigger frame, for example:

[redacted]

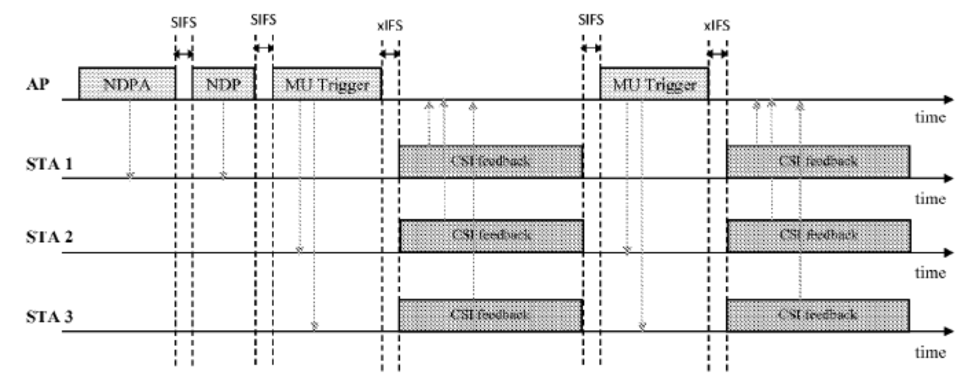


Figure 5

It is also possible for the AP to transmit the MU trigger frame again after uplink MU transmissions of CSI feedback as shown in Figure 5 (for both option 1 and 2). This procedure may be needed if the STAs weren't able to fit all the CSI feedback in the uplink MU transmission.

ATLAS-00019292

14.3.18The '419 Provisional Fully Supports '919 Claim 9, 14

1829. Claim 9 of '919 recites: "The method of claim 3, wherein transmitting the first CSI feedback in response to receiving the first trigger frame comprises: transmitting the first CSI feedback a second predetermined IFS after receiving the first trigger frame." Similarly, claim 14 of '919 recites: "The method of claim 13, wherein receiving the first CSI feedback in response to transmitting the first trigger frame comprises: receiving the first CSI feedback a second predetermined IFS after transmitting the first trigger frame."

1830. The '419 provisional fully discloses receiving the second feedback frame a second interspace frame after receiving the trigger frame, for example:

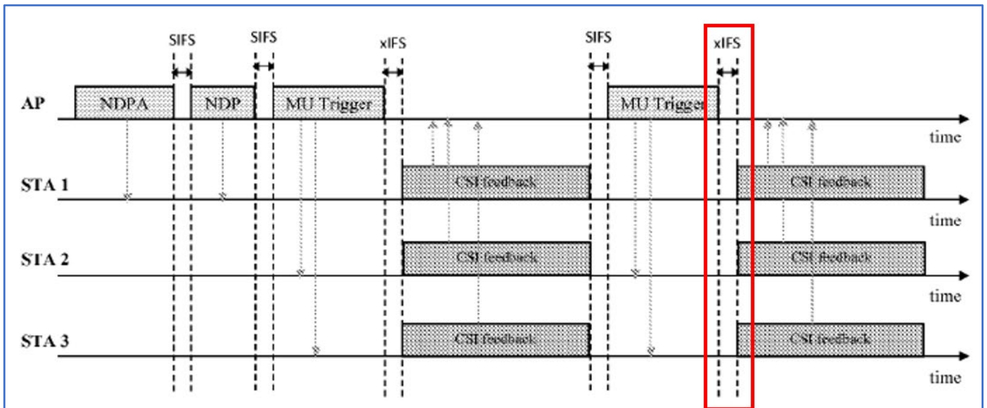


Figure 5

ATLAS-00019292.

[redacted]

1831. Based at least on the foregoing citations and figures, it is my opinion that the ’919 claims are supported by the provisional application.

1832. Dr. Hansen provides an analysis of the ‘919 priority claims, which I mostly agree with. Hansen Report at ¶58. I particularly agree with Dr. Hansen that the ‘919 claimed inventions were “constructively reduce[d] … to practice by filing U.S. Provisional Application No. 62/331,380 on October 12, 2015.” *Id.*

14.4 Claim Construction

1833. The Court issued a claim construction order on February 8, 2023 (“Claim Construction Order” or “Markman Order”). Dkt. No. 117. I have applied the constructions therein. For terms the court did not construe, I have applied the plain and ordinary meaning to a person of ordinary skill in the art at the time of invention.

1834. With respect to the ’919 Patent, the Court construed the following terms:

Term or phrase	Court’s Construction
“in response to determining that the number of the one or more station information fields in the NDPA is one,” (claim 1)	Plain meaning
“when a number of the one or more station information fields in the NDPA is one” (claim 11)	Plain meaning
“when the number of the one or more station information fields in the NDPA is greater than one” (claims 2, 8, 12, 19)	Plain meaning
“Cardinality”	Plain meaning
“wherein the number of the one or more station information fields in the NDPA is the cardinality of the one or more station information fields in the NDPA” (claim 1)	Plain meaning
“wherein the number of the one or more station information fields in the NDPA is exactly the cardinality of the one or more station information fields in the NDPA” (claim 11)	Plain meaning

Dkt. No. 117 at 54, 55, 58

[redacted]

1835. In adopting the plain meaning of these terms, the Court "expressly reject[ed] Defendants' indefiniteness argument." *Id.* at 53, 58.

1836. For the purposes of clarity, I note that "cardinality" is a common term in mathematics meaning "the number of elements in a set." *See* ATLAS-00019155. A person of skill in the art would understand this meaning without the need to rely on intrinsic or extrinsic evidence. The PTAB has reached a similar conclusion. IPR2022-01520, Paper 25 at 15-18 ("we construe the Cardinality Limitation to have its plain and ordinary meaning, or in other words, to mean "wherein the number of the one or more station information fields in the NDPA is the number of elements in the set of station information fields.").

14.5 Overview of Dr. Hansen's Alleged '919 Prior Art

1837. Dr. Hansen analyzes seven references in connection with the '919 Patent: (1) U.S. Patent Publication 2016/0262051 to Simon Merlin et al ("Merlin," Hansen Ex. 919-2); (2) "Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications Amendment 4: Enhancements for Very High Throughput for Operation in Bands below 6 GHz" ("802.11ac-2013", Hansen Ex. 919-3); (3) "Reducing Channel Sounding Protocol Overhead for 11ax" ("802.11-15/1097r1, Hansen Ex. 919-4); (4) U.S. Patent No. 10,349,388 to Jinyoung Chun, et al ("Chun 388", Hansen Ex. 919-5); (5) U.S. Patent Publication 2013/023547 to Zongming Yao et al ("Yao," Hansen Ex. 919-6), (6) U.S. Patent No. 9,788,317 to Chittabrata Ghosh et al ("Ghosh", Hansen Ex. 919-7); (7) Chinese Patent Publication CN 102843177A purportedly to Yang ("Yang", Hansen Exs. 919-8 and 919-9).

14.5.1 Merlin 051

1838. Merlin '051 is titled "Method and apparatus for channel state information and sounding feedback." Merlin '951 at Title Page. Merlin generally relates to "wireless communications, and more particularly, to methods and apparatus for channel state information sounding and feedback." Merlin '051 at [0003]. It describes "an improved protocol for uplink of channel state information from multiple terminals." Merlin at [0007].

[redacted]

1839. Dr. Hansen has not proven that Merlin ’051 is prior art to the ’919 Patent. Merlin ’051 was filed on February 19, 2016 (which is four months after the ’919 Patent’s October 12, 2015 priority effective date). But Merlin ’051 claims priority to two provisional applications, filed on March 2, 2015 and September 30, 2015. Thus, Merlin ’051is only prior art under post-AIA §102(a) if Dr. Hansen proves that the disclosures from Merlin ’051that he relies upon are fully supported by either of Chun’s provisional applications. Yet Dr. Hansen never performs this analysis. Accordingly, Dr. Hansen has not met his burden to prove that Merlin ’051is prior art to the ’919 Patent.

14.5.2 802.11ac-2013

1840. 802.11ac is a 2013 amendment to prior IEEE 802.11 Wi-Fi standards. 802.11ac at 2. The specification of the ’919 Patent references the 802.11ac standard and builds on it by inventing a technique for multi-user feedback. ’919 at 1:38-47.

1841. 802.11ac describes many aspects of a WLAN network. Notably, 802.11ac describes what it terms a Very High Throughput (“VHT”) method of WLAN. *See* SER-1004 at 1.

1842. Dr. Hansen focuses on 802.11ac’s VHT sounding procedure. This procedure, which only allows feedback by a single station at a time, is illustrated in figures 9-41a and 9-41b, reproduced below:

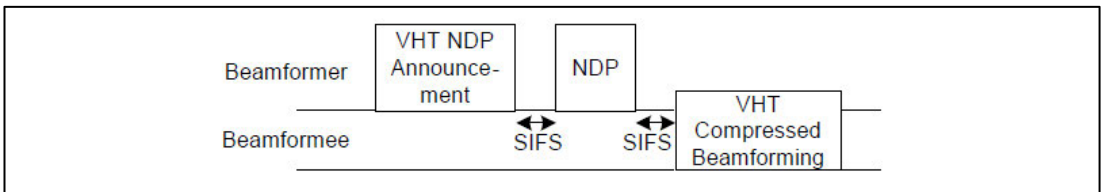


Figure 9-41a—Example of the sounding protocol with a single VHT beamformee

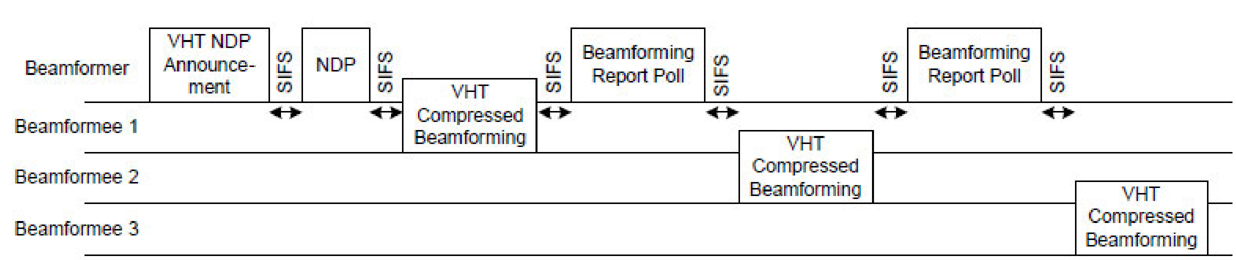


Figure 9-41b—Example of the sounding protocol with more than one VHT beamformee

[redacted]

802.11ac at Figs. 9-41a, 9-41b.

1843. As illustrated above, 802.11ac describes two methods for beamforming. The first is directed only to a single station, and the second is directed to multiple stations. In the first method, an AP transmits an NDPA to a single station and sets the Feedback Type subfield of the STA info field to SU and sets the RA address to the MAC of the station. SER-1004 at 169. This signals to the station that a single user feedback method will be used. In the second method, an AP transmits an NDPA with more than one STA Info field and sets the RA of the NDPA to a broadcast address. *Id*. This informs the station that the second method should be used, and stations whose station information fields are not the first in the set will wait for a beamforming report poll before sending feedback.

1844. Unlike the '919 Patent, 802.11ac does not teach that the number of station information fields affects the sounding procedure. Instead, 802.11ac relies on the order of stations within the NDPA to dictate the sounding procedure.

1845. 802.11ac was also asserted against the '919 patent in the IPR filed by Sercomm. *See* IPR2022-01520, Paper 25 at 20-24. The PTAB concluded that 802.11ac did not disclose "combined features of "determining" that the number of elements in the set of STA Info fields "is one," and "in response to" that determination, transmitting first CSI feedback in response to receiving the NDP." IPR2022-01520, Paper 25 at 20-24.

14.5.3 802.11-15/1097r1

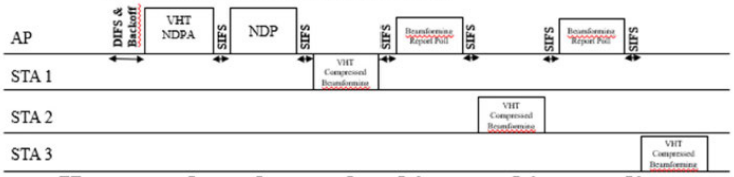
1846. 802.11-15/1097r1 is a document titled "Reducing Channel Sounding Protocol." 802.11-15/1097r1 at 1. It describes sounding methods implemented in 802.11ac and proposed sounding methods for 802.11ax.

1847. 802.11-15/1097r1 describes several multiuser feedback methods at a high level, for example:

[redacted]

11ac Sounding Protocol

- **DL-MU-MIMO relies on channel state information (CSI) obtained during sounding for pre-coding**
- **Protocol overhead from sounding and CSI feedback**
  - MU-MIMO needs frequent updates of CSI
  - Overhead increase with number of STAs



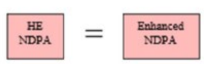
- **How to reduce the overhead incurred in sounding protocol for 11ax?**
  - Compressed beamforming frames (response to NDPA/NDP) from the STAs can be multiplexed using UL MU-MIMO/UL OFDMA

How to enable UL multiplexing for Compressed Beamforming frames?

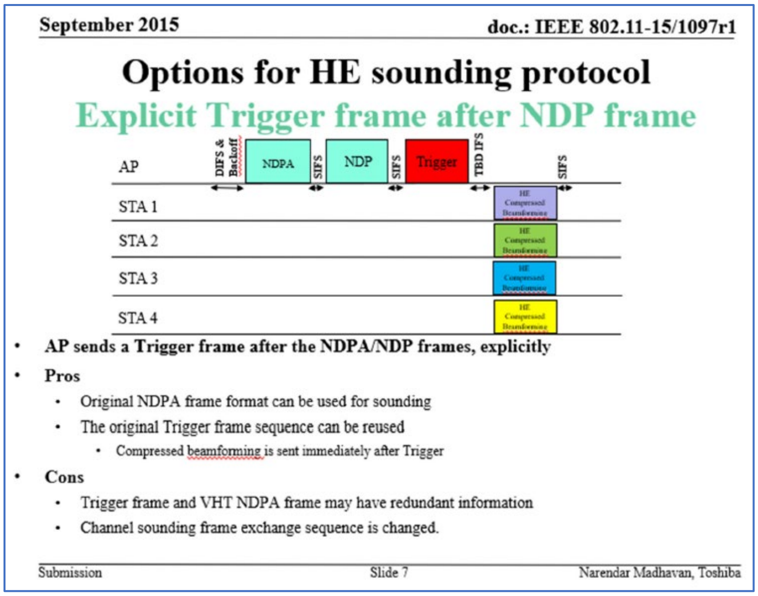
- **Aggregated NDPA and Trigger frame**

- **Explicit Trigger frame after NDP frame**

- **Enhanced NDPA frame**

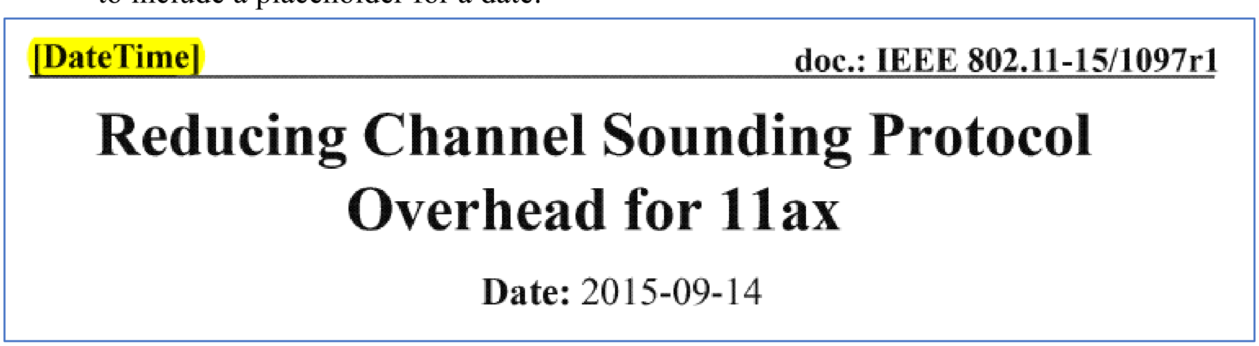


[redacted]



802.11-15/1097r1 at 3, 5, 7. As these figures illustrate, 802.11-15/1097r1 only describes multi-user feedback. And unlike the ’919 Patent, nothing in 802.11-15/1097r1 suggests any method for determining whether to send single user or multi-user feedback. Moreover, 802.11-15/1097r1 does not provide any explanation regarding the station information field in the NPDA, or the contents of the NDPA frame.

1848. Dr. Hansen has not provided any analysis, or even alleged, that this document was publicly available prior to the filing date of the ’919 Patent. Though the document bears the date September 14, 2015, Dr. Hansen has not provided any evidence or analysis to support a conclusion that it was, in-fact, publicly available on that date. Moreover, the document Dr. Hansen relies on does not appear to be an authentic copy of the document available on the IEEE’s website. For example, the document Dr. Hansen relies on appears to include a placeholder for a date:


[DateTime] doc.: IEEE 802.11-15/1097r1

Reducing Channel Sounding Protocol Overhead for 11ax

Date: 2015-09-14

[redacted]

802.11-15/1097r1 at 1 (annotated).

1849. On the other hand, the document available on the IEEE website includes September 2015 in that location:

September 2015 **doc.: IEEE 802.11-15/1097r1**

Reducing Channel Sounding Protocol Overhead for 11ax

Date: 2015-09-14

"Reducing Channel Sounding Protocol Overhead for 11ax" at 1 *available at* https://mentor.ieee.org/802.11/dcn/15/11-15-1097-01-00ax-reducing-channel-sounding-protocol-overhead-for-11ax.pptx (annotated).

14.5.4 Chun

1850. Chun 388 is U.S. Patent No. 10,349,388. It describes methods for sending feedback information to an access point. In particular, Chun 388 describes a very high throughput ("VHT") feedback technique similar to that described by 802.11ac, SER-1007 at 1:40-47, and a high efficiency ("HE") feedback technique, *id.* at 2:4-24.

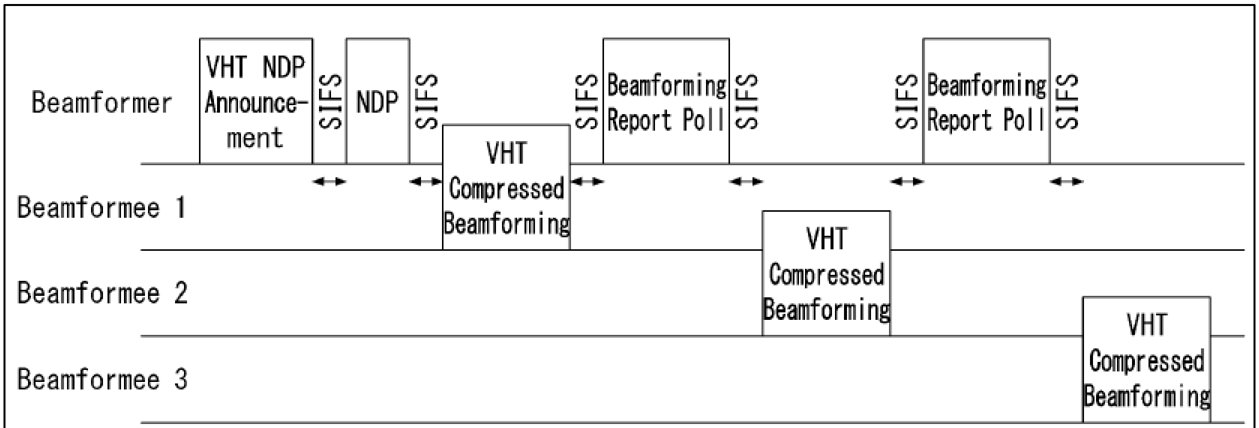
1851. As Chun 388 explains, VHT was developed to support the 802.11ac WLAN standard:

> As the spread of a WLAN is activated and applications using the WLAN are diversified, in the next-generation WLAN system supporting a very high throughput (VHT), IEEE 802.11ac has been newly enacted as the next version of an IEEE 802.11n WLAN system. IEEE 802.11ac supports a data rate of 1 Gbps or more through 80 MHz bandwidth transmission and/or higher bandwidth transmission (e.g., 160 MHz), and chiefly operates in a 5 GHz band.

SER-1007 at 1:40-46.

1852. Chun 388 describes several aspects of VHT transmission, and the VHT channels sounding and feedback method is illustrated in figure 8:

[redacted]



[Fig. 8]

1853. As illustrated above, the VHT method of Chun 338 first sends a VHT NDPA frame to notify the station(s) that channel sounding is initiated. SER-1007 at 23:33-39. The VHT NDPA includes data that identifies which station will send feedback, such as "association identifier (AID) information, feedback type information, etc." *Id.* at 23:40-43. The VHT PPDU may also be transmitted using different methods if SU-MIMO or MU-MIMO is used. *Id.* at 23:44-51. For the former, the VHT NDPA would be transmitted to a single station, while the latter would be transmitted using broadcast methods. Id.

1854. Following the VHT NDPA, an VHT NDP is sent. *Id.* at 23:52-54. A station that has received a VHT NDPA will then check the value of the AID12 subfield to determine whether it is a target of the sounding procedure. *Id.* at 23:55-58.

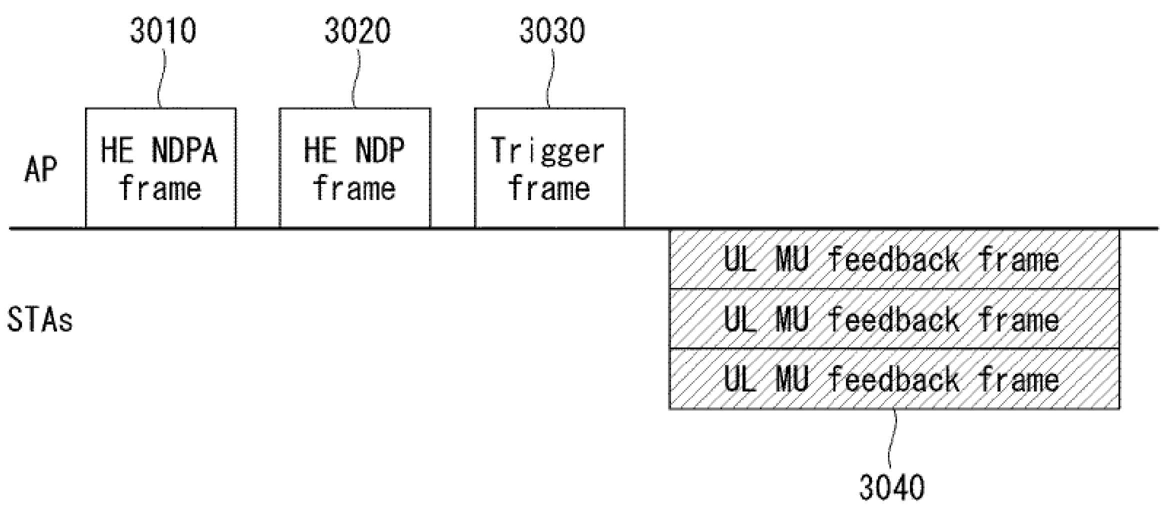
1855. Importantly, Chun 338 also explains that, in the VHT feedback procedure, a station knows whether it is to respond immediately by identifying which STA Info field in a sequence of STA Info fields is directed to the station. *Id.* at 23:59-63. In the case of Figure 8, the feedback sequence is performed in the order of station 1, station 2, then station 3. *Id.*

[redacted]

1856. After receiving the VHT NDP, the first station in the sequence transmits feedback information to the beamformer. *Id.* at 24:1-3. Subsequent stations transmit their feedback information after a polling frame. *Id.* at 24:10-18.

1857. Chun 388 also describes an HE sounding method. *Id.* at 50-60. According to Chun 388, HE sounding is part of a "next-generation system." *Id.* at 52:32-36. One such technique is illustrated in Figure 30:

[Fig. 30]



1858. Like the VHT sounding method, Chun 338's HE sounding method begins with a NDPA frame. *Id.* at 51:50-54. This NDPA notifies the stations that the sounding protocol is beginning and to expect an NDP. *Id.* Like the VHT method, control information is included in the NDPA, such as "feedback indication information (or sounding indication information) regarding that which STA will measure which DL channel using what method." *Id.* at 51:55-60.

1859. In this embodiment, the AP then sends a NDP frame followed by a trigger frame. *Id.* at 51:61-18. Stations that receive the trigger frame can measure channel state and generate feedback. *Id.* at 52:19-26.

1860. Chun 388 then describes several methods of signaling to the station which feedback method should be used. *See id.* at 52:56-54:56. In Option 1, the VHT control field is modified to include information used by the station to determine whether it will participate

[redacted]

in feedback. *Id.* at 53:8-36. In Option 2, a new HE control field is used that includes similar signaling information. *Id.* at 54:5-33. Indeed, Chun 388 devotes several columns to describing the data that can be included in the NDPA to signal to the station how to provide feedback.

1861. Unlike the ’919 Patent, Chun 388 does not teach that the number of station information fields affects the sounding procedure. Instead, Chun 388 relies on information and bits within modified fields in the NDPA to dictate the sounding procedure. The PTAB also concluded that Chun 388 did not disclose “combined features of “determining” that the number of elements in the set of STA Info fields “is one,” and “in response to” that determination, transmitting first CSI feedback in response to receiving the NDP.” IPR2022-01520, Paper 25 at 35-38.

1862. Dr. Hansen has not proven that Chun is prior art to the ’919 Patent. Chun was filed on August 19, 2016 (which is nearly 10 months after the ’919 Patent’s October 12, 2015 priority effective date). But Chun claims priority to three provisional applications, filed on August 19, 2015, August 26, 2015, and December 8, 2015. Thus, Chun is only prior art under post-AIA §102(a) if Dr. Hansen proves that the disclosures from Chun that he relies upon are fully supported by either of Chun’s August 2015 provisional applications. Yet Dr. Hansen never performs this analysis. Accordingly, Dr. Hansen has not met his burden to prove that Chun is prior art to the ’919 Patent.

14.5.5 Yao

1863. Yao is titled “Data Feedback Methods and Related Apparatuses.” Yao at Title Page. Yao generally relates to “data feedback methods and related apparatuses.” Yao at [0002]. Yao describes a method for channel sounding. Yao’s figure 2 describes steps taken by a beamformee after receiving an NDPA frame:

[redacted]

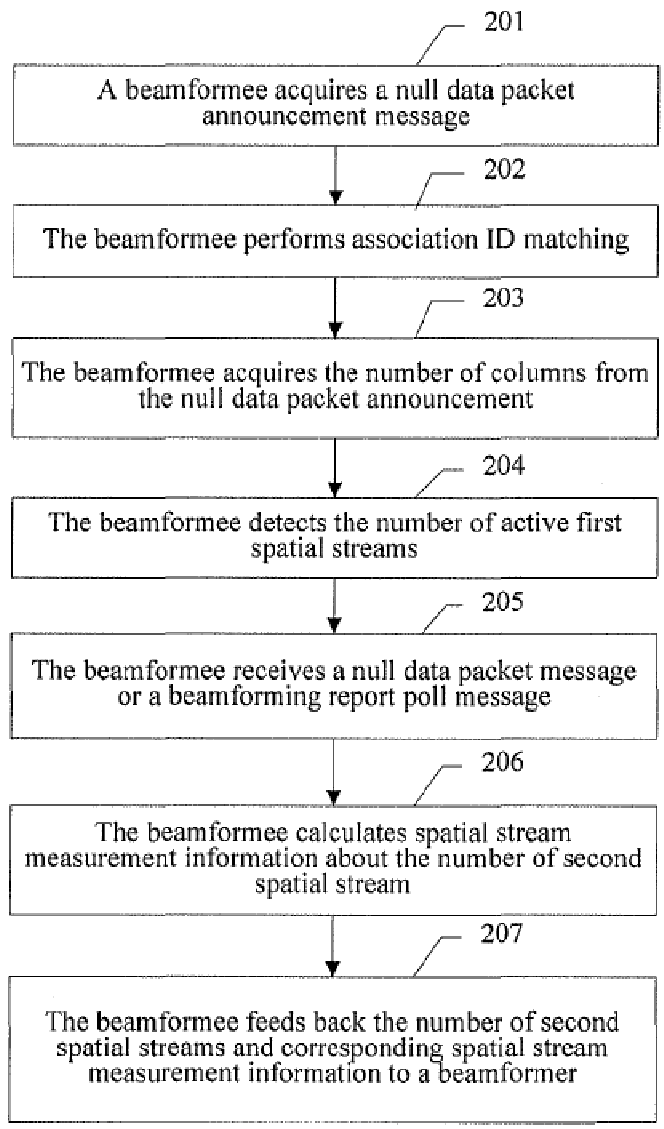


FIG. 2

1864. Yao. Fig. 2. This process begins with a station receiving a null data packet announcement ("NDPA") frame. The NDPA includes a number of fields, including the number of columns and STA Info fields. Yao at [0032], [0036], [0042], [0043]. The number of columns is indicated by adding 1 the Nc Index field set by the beamformer in the NDPA and indicate the number of spatial streams that a STA needs to feed back. Yao at [0027]. Within the STA Info filed is the Feedback Type subfield which indicates whether the transmission is SU-MIMO (when the Feedback Type is 0) or MU-MIMO (when the

[redacted]

Feedback Type is 1). Yao at [0042]-[0043]. Also in the STA Info field is the Association ID (AID) subfield which identifies the station assigned to the STA Info field. Yao at [0042].

1865. According to Yao, after receiving the NDPA, the beamformee "performs association ID matching." Yao [0044]. In this step, the beamformee "extracts [the] STA Info fields sequentially from the NDPA message and compares the AIDs [(association IDs)] of the STA Info field one by one with the locally stored AID" of the beamformee. Yao [0045]. If the station identifies a match between its AID and the AID in the STA Info field, the STA understands that "the NDPA message needs to be locally received." Yao at [0045]. Next, the station reads the number of columns and Feedback Type from the NDPA. Yao at [0046]-[0047]. Finally, the station detects the number of active spatial streams. Yao at [0048].

1866. Next, "The beamformee receives a null data packet message or a beamforming report poll message." Yao [0050]. In the case of the NDP, the beamformee checks whether the AID in the NDP matches its AID, and if so, sends its feedback in response. Yao [0051]. In the case of receiving a beamforming report poll, the beamformee simply detects whether it has received the poll, and if so, sends tis feedback. Yao [0053].

1867. Unlike the '919 Patent, Yao does not determine a number of station information fields in the NDPA or use the number of station information fields to determine which type of feedback to use. Yao also does not describe multi-user feedback.

14.5.6 Ghosh

1868. Ghosh is U.S. Patent No. 9,788,317, titled "Access Point (AP), User Station (STA) and Method for Channel Sounding Using Sounding Trigger Frames." SER-1005 at 1. Ghosh generally relates to a trigger-based sounding method in a WLAN system. SER-1005 at Abstract, Fig. 3.

1869. Ghosh's method of sounding in a multi-station wireless network is illustrated by Figure 3:

[redacted]

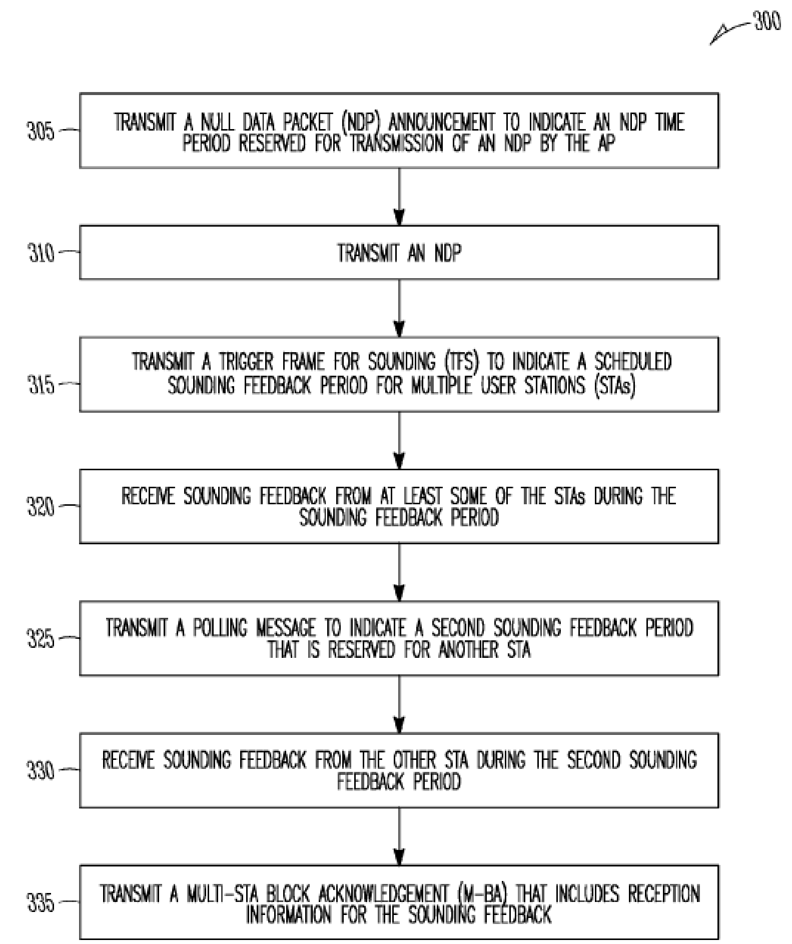


FIG. 3

Ghosh at Fig. 3. In this method, the AP first transmits an NDPA followed by an NDP. *Id.* at steps 305-310. Following the NDP, the AP transmits a trigger frame with feedback scheduling information for any responding stations. *Id.* at step 315. After the stations respond accordingly, the AP sends a multi-station block acknowledgement to the stations and may send subsequent polling messages to receive feedback from separate subsets of the stations. *Id.* at step 335.

1870. Unlike the ’919 Patent, Ghosh does not disclose sending feedback in the absence of a trigger frame, or that the number of station information fields affects the sounding procedure. Instead, Ghosh only discloses sending feedback after a trigger frame.

14.5.7 Yang

1871. Yang appears to be Chinese patent publication 102843177A. Hansen Ex. 919-8. However, it is written entirely in Chinese, and I do not speak Chinese. Dr. Hansen never

[redacted]

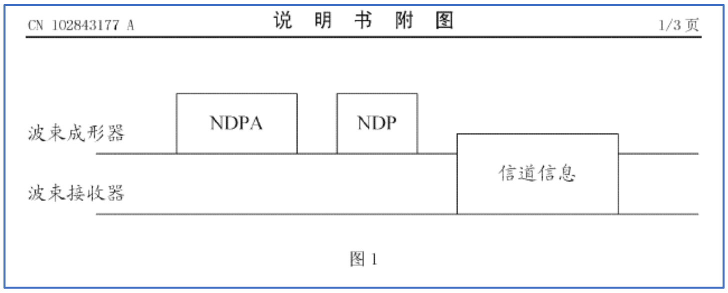
cites to the Chinese version of Yang, but rather cites to Google's computerized, non-certified English translation of Yang. Hansen Report at p. 1357, fn. 2 (citing https://patents.google.com/patent/CN102843177A/en?oq=CN102843177, Hansen Ex. 919-9). I find it improper to cite to a Google computerized translation of Yang; Google translations are not accurate. *E.g.*, https://www.pactranz.com/google-translate-accuracy-issues/; https://lptranslations.com/learn/how-accurate-is-google-translate/. And upon reading the Google computerized translation of Yang, I find it mostly incoherent "techno-babble." This is likely due to the faulty translation procedure. Dr. Hansen also cites to paragraph number that are not present in the Google translation, so it is impossible to determine whether his citations correspond to the text he quoted. Nonetheless, the following summarizes Google's computerized translation of Yang.

1872. Yang appears to relate to a "method for issuing channel information." Yang at 1 (Abstract). According to Yang, the method comprises receiving a NDPA that includes "stations number and station list information[,] and the station number the station number is used for indicating the quantity of the receiving ends in the station list information." *Id.* According to Yang, "the receiving ends read the information in the station list information in order to decide whether information corresponding to the receiving ends is included or not." *Id.* Yang appears to explain that if the station number exceeds the assigned station number of the receiving device, the receiving device "finish[es] reading the station list information… and if the station list information includes the information corresponding to the receiving ends, the receiving ends receive a null data packet (NDP) respectively…." *Id.* The receiving device then transmits channel information to the sending device. *Id.*

1873. Unlike the '919 Patent, Yang does not appear to suggest determining the total number of station information fields, or using that total in any way. Instead, Yang teaches that the receiving devices should react when their assigned station number is contained in an NDPA, and stop processing the NDPA when their assigned station number is reached.

[redacted]

Yang appears to describe an approach similar to that of 802.11ac, as illustrated by Figure 1 of the Yang Chinese application:



Ex. 919-8 at 7.

14.6 Dr. Hansen's Alleged Prior Art Does Not Invalidate the Asserted '919 Claims

1874. Dr. Hansen states that each of the following references anticipate the Asserted '919 claims: Merlin '051, 802.11ac-2013, 802.11-15/1097r1, Chun, Yao, Ghosh, and Yang. Hansen Report at ¶3399. Dr. Hansen also states that those same references render the Asserted '919 claims obvious, either by themselves or in any combination of those five references. *Id.* I disagree.

14.6.1 Merlin '051 Fails To Disclose Or Render Obvious Several '919 Claim Limitations

14.6.1.1 Merlin Is Not Prior Art

1875. As explained above in §14.2.1 overview of Merlin '051, Dr. Hansen has not proven that Merlin is prior art to the '919 Patent. Accordingly, Dr. Hansen cannot show that all the claim limitations are taught or suggested by Merlin '051, and Dr. Hansen's '919 invalidity analysis based on Merlin '051 necessarily fails.

14.6.1.2 Merlin Fails To Disclose Or Render Obvious That Feedback Is Transmitted Or Received "[In Response To Determining That The/When A] Number Of The One Or More Station Information Fields In The NDPA Is One" ([1D], [11C])

1876. Independent claim [1.D] of the '919 Patent recites "***in response to determining that the number of the one or more station information fields in the NDPA is one***, transmitting first Channel State Information (CSI) feedback in response to receiving the NDP." '919 Patent at 33:4-7 (emphasis added). While independent claim [11.C] does not state that

[redacted]

feedback should be sent "in response to" the determination, it recites something similar: "***when a number of the one or more station information fields in the NDPA is one***, receiving first Channel State Information (CSI) feedback transmitted in response to the NDP[A] having only one station information field." *Id.*, 34:5-9 (emphasis added).

1877. As an initial matter, I note that Claim [11.C] appears to included a typographical error that suggested the NDP, rather than the NDPA discussed elsewhere, had station information fields. *Id.* at 162, 164 (compare claim 1 with claim 11). I discuss this issue below in section 16.2 and incorporate that discussion here.

1878. Dr. Hansen cites evidence that he asserts proves Merlin '051 discloses these limitations. Hansen Report at ¶¶3735-3740 (1[D]), ¶¶4221-4222 (11[C]). But Merlin '051 does not teach or suggest these limitations, as described below.

1879. Dr. Hansen cites various passages from Merlin 051 that characterize its HE and VHT sounding methods. *E.g.*, Hansen Report at ¶3736 (citing Merlin '051 at [0067]) ("In some aspects, sounding announcement 401 indicates that sounding NDP 405 is an HE NDP or a VHT NDP."). However, none of the Merlin '051 passages cited by Dr. Hansen teach responding in response to determining that the number of station information fields in the NDPA is one.

1880. Merlin '051's teachings regarding determining whether to transmit feedback is not the same as the claims of the '919. In the paragraph cited by Dr. Hansen, Merlin '051 explains that an NDPA indicates that sounding is either HE of VHT based on indication bits contained in the NDPA:

> In some aspects, **<u>sounding announcement 401 indicates that sounding NDP 405 is an HE NDP or a VHT NDP</u>**. This indication may comprise one or more bits in the sounding announcement **401**. In one embodiment, a reserved bit in the NDPA sounding dialog token field is used to indicate that sounding NDP **405** is an HE NDP, or that sounding NDP **405** is a VHT NDP. In another embodiment, AP **110** designates a specific value of the dialog token field to indicate HE sounding or VHT sounding. In accordance with any of these embodiments, the wireless communication devices **120** receiving the sounding NDP **405** know whether to respond with CSI using HE sounding or VHT sounding.

[redacted]

Merlin ’051 [0067] (emphasis added).

1881. Dr. Hansen never describes a disclosure in Merlin ’051 that teaches or suggests that feedback is sent based on the number of station information fields in the NDPA. For these reasons, it is my opinion that Merlin ‘690 does not teach or suggest these claim limitations.

14.6.2 802.11ac-2013 Fails To Disclose Or Render Obvious Several ‘919 Claim Limitations

14.6.2.1 802.11ac Does Not Disclose or Render Obvious “Wherein The Number Of The One Or More Station Information Fields In The NDPA Is [Exactly] The Cardinality Of The One Or More Station Information Fields In The NDPA.” ([1E], [11D])

1882. Independent claim [1.E] recites “wherein the number of the one or more station information fields in the NDPA ***is the cardinality*** of the one or more station information fields in the NDPA.” ’919 at 33:8-10 (emphasis added). Independent claim [11.D] recites essentially the same thing, except it requires that the number of station information fields in the NDPA is “***exactly the cardinality***” of the station fields in the NDPA. *Id.*, 34:9-11 (emphasis added). These elements inform earlier claim elements in both independent claims that relate to “one or more station information fields” in the NDPA. *See id.* at 32:66-33:2 ([1.A], [1.B]), 33:4-7 ([1.D]), 34:1-3 ([11.A]), 34:5-8 ([11.C]). As an initial matter, “cardinality” is a common term in mathematics meaning “the number of elements in a set.” *See* ATLAS-00019155. A person of skill in the art would understand this meaning without the need to rely on intrinsic or extrinsic evidence. Thus, these claims require knowledge of the total number of station information fields in the NDPA in order to practice the claim.

1883. Dr. Hansen points to disclosures in 802.11ac that he contends discloses these elements. Hansen Report ¶¶3827-3836, ¶4236-4237. But 802.11ac does not teach or suggest these limitations, as described below.

1884. 802.11ac does not describe any way or reason to know the cardinality of the station information fields (*i.e.*, the total number of fields). Instead, 802.11ac focuses entirely on the ordering of station information fields in the NDPA.

[redacted]

1885. The sections of 802.11ac that Dr. Hansen relies on instead use the positioning of station information fields within the NDPA to control feedback timing. Specifically, 802.11ac teaches that, for the first station information field in an NDPA, the station will respond without awaiting a beamforming report poll if the station's AID is in the AID subfield of the first station information field:

> A non-AP VHT beamformee that receives a VHT NDP Announcement frame…that ***contains the VHT beamformee's AID in the AID subfield of the first (or only) STA Info field***… shall transmit the PPDU containing its VHT Compressed Beamforming feedback a SIFS after the VHT NDP.

1886. SER-1004 at 169 (emphasis added). For a later station information field, a station will respond only after receiving a beamforming report poll if the station's AID is in the AID subfield of the any station information field other than the first:

> A non-AP VHT beamformee that receives a VHT NDP Announcement…that ***contains the VHT beamformee's AID in the AID subfield of a STA Info field that is not the first STA Info*** field shall transmit its VHT Compressed Beamforming feedback a SIFS after receiving a Beamforming Report Poll with RA matching its MAC address and a non-bandwidth signaling TA obtained from the TA field matching the MAC address of the VHT beamformer.

Id. at 170 (emphasis added).

1887. Nowhere in these passages (or anywhere else) does 802.11ac teach cardinality in any way. Its discussion is focused entirely on station information field positioning within the NDPA and is agnostic to the total number of fields. Therefore, 802.11ac does not teach, suggest, or render obvious the "cardinality" elements of claims [1.E] and [11.D].

14.6.2.2 802.11ac Does Not Disclose Or Render Obvious That Feedback Is Transmitted Or Received "[In Response To Determining That The/When A] Number Of The One Or More Station Information Fields In The NDPA Is One" ([1D], [11C])

1888. Independent claim [1.D] of the '919 Patent recites "***in response to determining that the number of the one or more station information fields in the NDPA is one***, transmitting first Channel State Information (CSI) feedback in response to receiving the NDP." '919 at 33:4-7 (emphasis added). While independent claim [11.C] does not state that feedback

[redacted]

should be sent "in response to" the determination, it recites something similar: "***when a number of the one or more station information fields in the NDPA is one***, receiving first Channel State Information (CSI) feedback transmitted in response to the NDP[A] having only one station information field." *Id.*, 34:5-9 (emphasis added).

1889. As an initial matter, I note that Claim [11.C] appears to included a typographical error that suggested the NDP, rather than the NDPA discussed elsewhere, had station information fields. *Id.* at 162, 164 (compare claim 1 with claim 11). I discuss this issue below in section 16.2 and incorporate that discussion here.

1890. Dr. Hansen cites evidence that he asserts proves 802.11ac discloses these limitations. Hansen Report at ¶¶3741-3760 (1D), ¶¶4223-4224 (11C). But 802.11ac-2013 does not teach or suggest these limitations, as described below.

1891. Dr. Hansen relies in the VHT beamforming process described by 802.11ac as illustrated in Figures 9-41a and 9-41b:

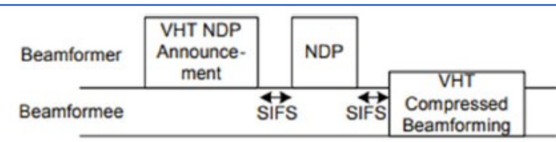


Figure 9-41a—Example of the sounding protocol with a single VHT beamformee

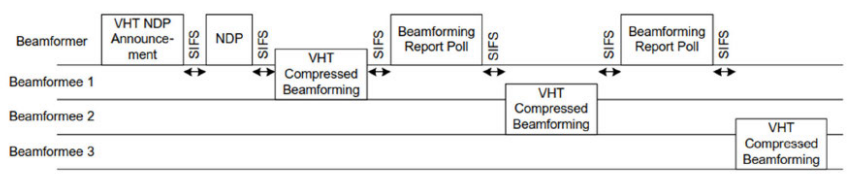


Figure 9-41b—Example of the sounding protocol with more than one VHT beamformee

Hansen Report at ¶¶3750; *see also id.* at ¶¶3743.

1892. But nothing in 802.11ac suggests that channel sounding feedback is sent or received in relation to the total number of station information fields. Instead, 802.11ac's first station responds to the NDP if its AID is in the first station information field in an NDPA, regardless of the total number of station information fields. *Compare* SER-1004 at 169 ("A non-AP VHT beamformee that receives a VHT NDP Announcement frame…that contains the VHT beamformee's AID in the ***AID subfield of the first (or only) STA Info field***…

[redacted]

shall transmit the PPDU containing its VHT Compressed Beamforming feedback a SIFS after the VHT NDP.") *with* 170 ("A non-AP VHT beamformee that receives a VHT NDP Announcement…that contains the VHT beamformee's AID in the AID subfield of a STA Info field ***that is not the first STA Info*** field shall transmit its VHT Compressed Beamforming feedback a SIFS after receiving a Beamforming Report Poll…."). A key to 802.11ac's approach method is that a station information field is directed to the station, and that station information field is the first.

1893. Thus, Dr. Hansen has not shown that 802.11ac teaches, suggests, or renders obvious transmitting channel station information ***in response to*** determining that or ***when*** the number of the one or more station information fields in the NDPA is one.

1894. I also note that, the PTAB also concluded that 802.11ac did not disclose "combined features of "determining" that the number of elements in the set of STA Info fields "is one," and "in response to" that determination, transmitting first CSI feedback in response to receiving the NDP." IPR2022-01520, Paper 25 at 20-24.

14.6.2.3 802.11ac Does Not Disclose Or Render Obvious "when the number of the one or more station information fields in the NDPA is greater than one: [receiving/transmitting] a first trigger frame; and [transmitting/receiving] the first CSI feedback in response to receiving the first trigger frame." (2, 12)

1895. Claim 2 of the '919 Patent recites "***when the number of the one or more station information fields in the NDPA is greater than one***: receiving a first trigger frame; and transmitting the first CSI feedback in response to receiving the first trigger frame." '919 Patent at 33:12-17 (emphasis added). Claim 12 recites something similar: "***when the number of the one or more station information fields in the NDPA is greater than one***: transmitting a first trigger frame; and receiving the first CSI feedback in response to transmitting the first trigger frame." *Id.*, 34:12-17 (emphasis added).

[redacted]

1896. Dr. Hansen cites evidence that he asserts proves 802.11ac discloses these limitations. Hansen Report at ¶¶3883-3896 (2), ¶¶4362-4363 (12) (citing to his analysis for claim 2). But 802.11ac does not teach or suggest these limitations, as described below.

1897. Dr. Hansen apparently points to 802.11ac's discussion of the beamforming report poll described in 802.11ac. Hansen Report ¶¶3885. But, Dr. Hansen has provided no analysis of why he contends the beamforming report poll is equivalent to a trigger frame. Thus, Dr. Hansen has not shown that 802.11ac teaches, suggests, or renders obvious these elements.

14.6.2.4 802.11ac Does Not Disclose "[transmitting/receiving] the first CSI feedback in a multi user transmission in response to receiving the first trigger frame." (5, 16)

1898. Claim 5 of the '919 Patent recites "The method of claim 4, wherein transmitting the first CSI feedback in response to receiving the first trigger frame comprises: ***transmitting the first CSI feedback in a multi user transmission in response to receiving the first trigger frame***." Claim 16 recites something similar: "The method of claim 15, wherein receiving the first CSI feedback in response to transmitting the first trigger frame comprises: ***receiving the first CSI feedback in a multi user transmission in response to transmitting the first trigger frame***.".

1899. Dr. Hansen does not allege that 802.11ac discloses these elements. Moreover, 802.11ac only discloses single user feedback. In the context of multiple users, 802.11ac includes the ability to perform multiple rounds of sounding as illustrated in Figure 9-41b:

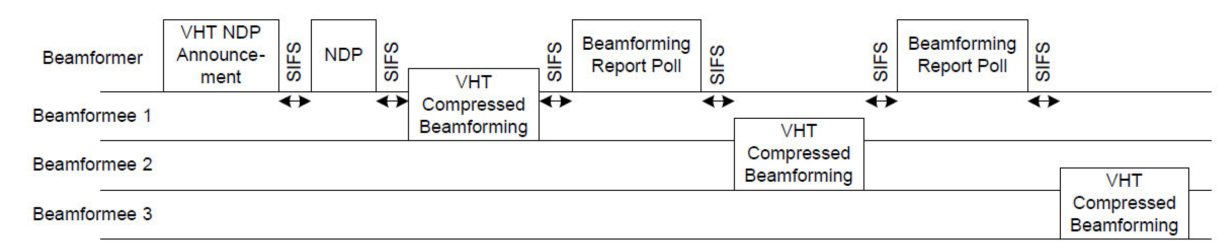


Figure 9-41b—Example of the sounding protocol with more than one VHT beamformee

802.11ac at 170.

[redacted]

1900. Thus, Dr. Hansen has not shown that 802.11ac teaches, suggests, or renders obvious these elements or any elements that depend from them.

14.6.3 802.11-15/1097r1 Fails To Disclose Or Render Obvious Several '919 Claim Limitations

14.6.3.1 Dr. Hansen has not shown that 802.11-15/1097r1 was publicly available before the effective filing date of the '919 Patent

1901. As explained above in §14.2.3 overview of 802.11-15/1097r1, Dr. Hansen has not proven that 802.11-15/1097r1is prior art to the '919 Patent. Accordingly, Dr. Hansen cannot show that all the claim limitations are taught or suggested by 802.11-15/1097r1, and Dr. Hansen's '919 invalidity analysis based on 802.11-15/1097r1 necessarily fails.

14.6.3.2 802.11-15/1097r1 Does Not Disclose or Render Obvious Any Element Of Claims 1, 3, 4, 6, 7, 8, 9, 11, 13, 15, 16, 18, 19

1902. Dr. Hansen has not alleged that 802.11-15/1097r1 discloses any element of claims 1, 3, 4, 6, 7, 8, 9, and 11. For claims 13, 15, 16, 18, and 19, Dr. Hansen cites back to his analysis for claims 3, 4, 7, or 8 and thus, he has not argued that 802.11-15/1097r1 discloses these claims. Thus, Dr. Hansen has not shown that 802.11-15/1097r1 teaches, suggests, or renders obvious any claim of the '919 Patent. Accordingly, Dr. Hansen's '919 invalidity analysis based on 802.11-15/1097r1 necessarily fails.

14.6.3.3 802.11-15/1097r1 Does Not Disclose Or Render Obvious "when the number of the one or more station information fields in the NDPA is greater than one: [receiving/transmitting] a first trigger frame; and [transmitting/receiving] the first CSI feedback in response to receiving the first trigger frame." (2, 12)

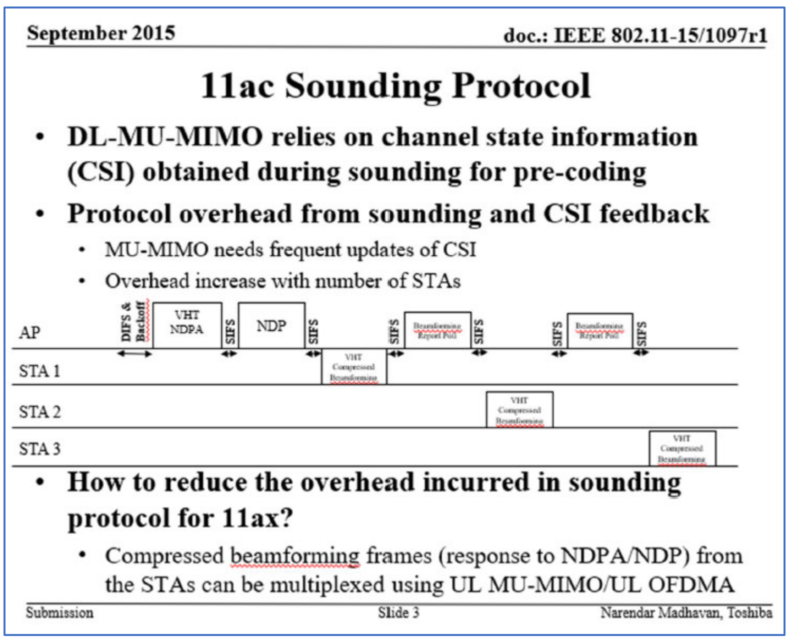
1903. Claim 2 of the '919 Patent recites "***when the number of the one or more station information fields in the NDPA is greater than one***: receiving a first trigger frame; and transmitting the first CSI feedback in response to receiving the first trigger frame." '919 Patent at 33:12-17 (emphasis added). Claim 12 recites something similar: "***when the number of the one or more station information fields in the NDPA is greater than one***: transmitting a first trigger frame; and receiving the first CSI feedback in response to transmitting the first trigger frame." *Id.*, 34:12-17 (emphasis added).

[redacted]

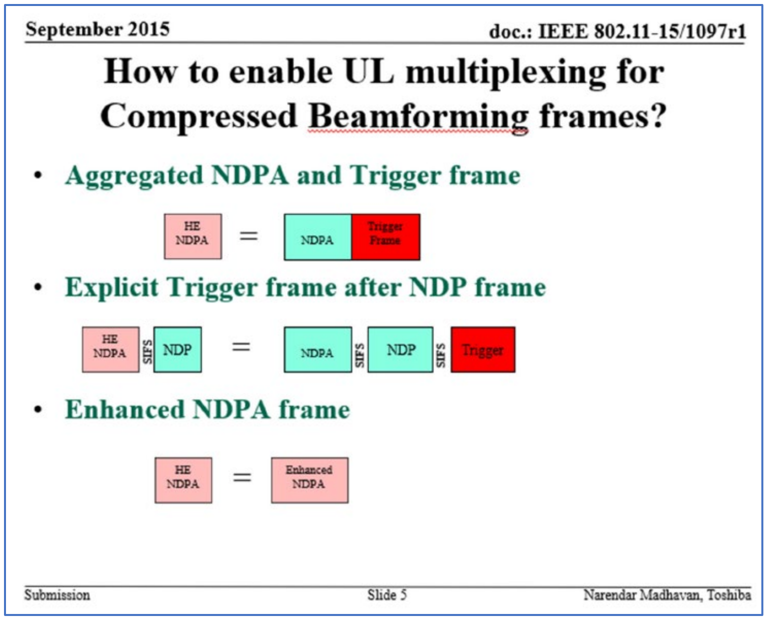
1904. Dr. Hansen cites evidence that he asserts proves 802.11-15/1097r1 discloses these limitations. Hansen Report at ¶¶3890-3896 (2), ¶¶4252-4253 (12) (citing to his analysis for claim 2). But 802.11-15/1097r1 does not teach or suggest these limitations, as described below.

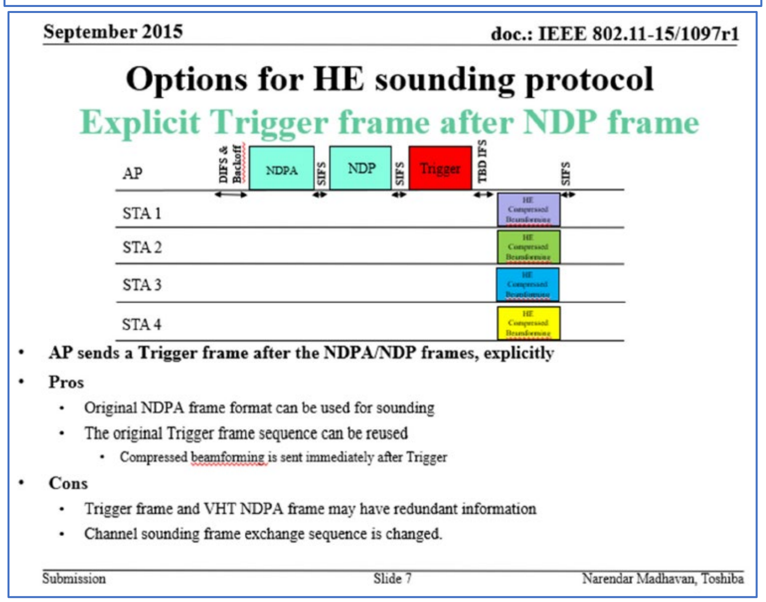
1905. As I explained above, Dr. Hansen has not provided any analysis of how 802.11-15/1097r1 teaches or suggests claim 1 or how 802.11-15/1097r1 is prior art, and thus, Dr. Hansen's '919 invalidity analysis based on 802.11-15/1097r1 necessarily fails.

1906. With respect to claims 2 and 12, Dr. Hansen points to 802.11-15/1097r1's discussion of various feedback sequences. Hansen Report at ¶¶3890-3896. In particular Dr. Hansen inserts images from 802.11-15/1097r1 illustrating the 802.11ac protocol, methods for enabling UL multiplexing, and a proposed HE sounding protocol:



[redacted]





Hansen Report ¶¶3892-3894 (quoting 802.11-15/1097r1 at 3, 5, 7).

1907. As these figures illustrate, 802.11-15/1097r1 also only describes multi-user feedback. And, nothing in 802.11-15/1097r1 suggests any method for determining whether to send single user or multi-user feedback. More specifically, nothing Dr. Hansen cites teaches or suggests that channel sounding feedback is sent or received in relation to the total number of station information fields. In fact, nothing Dr. Hansen cites in 802.11-15/1097r1 refers to station information fields.

[redacted]

1908. For these reasons, it is my opinion that 802.11-15/1097r1 does not teach or suggest these claim limitations.

14.6.4 Chun 388 Fails To Disclose Or Render Obvious Several '919 Claim Limitations

14.6.4.1 Chun 388 Is Not Prior Art

1909. As explained above in §14.2.4 overview of Chun 388, Dr. Hansen has not proven that Chun is prior art to the '919 Patent. Accordingly, Dr. Hansen cannot show that all the claim limitations are taught or suggested by Chun 388, and Dr. Hansen's '919 invalidity analysis based on Chun 388 necessarily fails.

14.6.4.2 Chun 388 Does Not Disclose or Render Obvious "Wherein The Number Of The One Or More Station Information Fields In The NDPA Is [Exactly] The Cardinality Of The One Or More Station Information Fields In The NDPA" ([1.E], [11.D])

1910. Independent claims [1.E] and [11.D] both recite "wherein the number of the one or more station information fields in the NDPA is [exactly] ***the cardinality*** of the one or more station information fields in the NDPA." As I explain above, "cardinality" means "the number of elements in a set." Applying these constructions of "cardinality," these claims require knowledge of the total number of station information fields in the NDPA in order to practice the claim.

1911. Dr. Hansen points to both Chun 388's VHT NDPA frame and the HE NDPA frame as describing this element. Hansen Report ¶¶3837-3846. But Chun 388 does not teach or suggest these limitations, as described below.

1912. Chun 388 does not describe any way or reason to know the cardinality of the station information fields (*i.e.*, the exact total number of fields). Instead, Chun 388 focuses entirely on signaling information contained within subfields of the NDPA.

1913. The sections of Chun 388 that Dr. Hansen relies on use the positioning of station information fields within the NDPA to control feedback timing. Like 802.11ac, Chun 388 teaches that, for the first station information field in an NDPA, the station will respond

[redacted]

without awaiting a beamforming report poll if the station's AID is in the AID subfield of the first station information field:

> Furthermore, the beamformees may be aware of a feedback sequence through the sequence of an STA Info field included in NDPA. Fig. 8 illustrates a case where a feedback sequence is performed in order of a beamformee 1, a beamformee 2, and a beamformee 3.
>
> ****
>
> After receiving the NDP frame, the beamformee 1 sends a VHT compressed beamforming frame, including feedback information, to the beamformer after an SIFS.

Chun 388 23:59-24:3. For a later station information field, a station will respond only after receiving a beamforming report poll if the station's AID is in the AID subfield of the any station information field other than the first:

> After receiving the VHT compressed beamforming frame from the beamformee 1, the beamformer sends a beamforming report poll frame to the beamformee 2 after an SIFS in order to obtain channel information for the beamformee 2.

Id. at 24:9-13.

1914. Similarly, the HE sounding methods described by Chun 388 do not teach the cardinality of the station information fields. These embodiments describe several methods of signaling to the station which feedback method should be used. *See id.* at 53:8-54:56. In Option 1, the VHT control field is modified to include information used by the station to determine whether it will participate in feedback. *Id.* at 53:8-36. In Option 2, a new HE control field is used that includes similar signaling information. *Id.* at 54:5-33. Indeed, Chun 388 devotes several columns to describing the data that can be included in the NDPA to signal to the station how to provide feedback, but none rely on the number of station information fields or the cardinality of the station information fields.

1915. Nowhere in these passages (or anywhere else) does Chun 388 teach cardinality in any way, much less that the cardinality of the number of the station information fields has any relation to the sounding process. Instead, Chun 388 is focused entirely on station information field positioning within the NDPA or on using fields within the NDPA to

[redacted]

dictate the sounding process, and is agnostic to the total number of fields. Therefore, Dr. Hansen has not shown that Chun 388 teaches, suggests, or render obvious the "cardinality" elements of claims [1.E] and [11.D].

14.6.4.3 Chun 388 Does Not Disclose Or Render Obvious That Feedback Is Transmitted Or Received "[In Response To Determining That The/When A] Number Of The One Or More Station Information Fields In The NDPA Is One" ([1.D], [11.C])

1916. Independent claim [1.D] of the '919 Patent recites "***in response to determining that the number of the one or more station information fields in the NDPA is one***, transmitting first Channel State Information (CSI) feedback in response to receiving the NDP." SER-1001, 33:4-7 (emphasis added). While independent claim [11.C] does not state that feedback should be sent "in response to" the determination, it recites something similar: "***when a number of the one or more station information fields in the NDPA is one***, receiving first Channel State Information (CSI) feedback transmitted in response to the NDP[A] having only one station information field." *Id.*, 34:5-9 (emphasis added).

1917. Like 802.11ac, Dr. Hansen contends that the same thing discloses both these claim elements: Chun 388's VHT SU beamforming method and Chun 388's HE MU Beamforming method. Hansen Report ¶¶3761-3781. But Chun 388 does not teach or suggest these limitations, as described below.

1918. Even accepting a proposed combination of Chun 388's VHT and HE sounding methods, nothing in Chun 388 suggests that channel sounding feedback is sent or received in relation to the total number of station information fields. Instead, Chun 388 uses data within the NDPA frame to indicate to the stations what feedback method will be used. As I explained above, Chun 388 devotes several columns to describing the data that can be included in the NDPA to signal to the station how to provide feedback. Chun 388 at 52:56-54:56. For example, to distinguish between VHT and HE methods, the HE control field is indicated by a reserved bit of a VHT format HT control field. 52:56-53:7 In Option 1 of the HE method, the VHT control field is modified to include information used by the station

[redacted]

to determine whether it will participate in feedback. *Id.* at 53:8-36. In Option 2, a new HE control field is used that includes similar signaling information. *Id.* at 54:5-33.

1919. In short, the key to Chun 388's approach is using signaling information in the NDPA to indicate how feedback will be performed. Nothing suggests that feedback should be sent ***in response to*** determining that or ***when*** the number of the one or more station information fields in the NDPA is one.

1920. Thus, Dr. Hansen has failed to show that Chun 388 teaches, suggests, or renders obvious transmitting channel station information ***in response to*** determining that or ***when*** the number of the one or more station information fields in the NDPA is one. I also note that the PTAB also concluded that Chun 388 did not disclose "combined features of "determining" that the number of elements in the set of STA Info fields "is one," and "in response to" that determination, transmitting first CSI feedback in response to receiving the NDP." IPR2022-01520, Paper 25 at 35-38.

1921.

14.6.5 Yao Fails To Disclose Or Render Obvious Several '919 Claim Limitations

14.6.5.1 Does Not Disclose or Render Obvious "Wherein The Number Of The One Or More Station Information Fields In The NDPA Is [Exactly] The Cardinality Of The One Or More Station Information Fields In The NDPA" ([1.E], [11.D])

1922. Independent claims [1.E] and [11.D] both recite "wherein the number of the one or more station information fields in the NDPA is [exactly] ***the cardinality*** of the one or more station information fields in the NDPA." As I explain above, "cardinality" means "the number of elements in a set." Applying these constructions of "cardinality," these claims require knowledge of the total number of station information fields in the NDPA in order to practice the claim.

1923. Dr. Hansen Points to Yao's discussion of the fields within the NDPA frame described by Yao. Hansen Report ¶¶3847-3854. But Yao does not teach or suggest these limitations, as described below.

[redacted]

1924. Yao does not describe any way or reason to know the cardinality of the station information fields (*i.e.*, the exact total number of fields). Instead, Yao focuses entirely on signaling information contained within subfields of the NDPA, NDP, and beamforming report poll.

1925. Dr. Hansen points to Yao's discussion of the NDPA and the feedback mechanism described by Yao. Hansen Report ¶¶3783-3784 (citing Yao [0027], [0038]-[0043]). Dr. Hansen also points to Yao's discussion of the information contained in Yao's NDPA frame. Hansen Report ¶¶3785-3790 (citing Yao [0045], [0047], [0051], [0062], [0087]-[0089], [0094]-[0095]). These sections of Yao focus largely on Yao's figure 2 and related discussion:

[redacted]

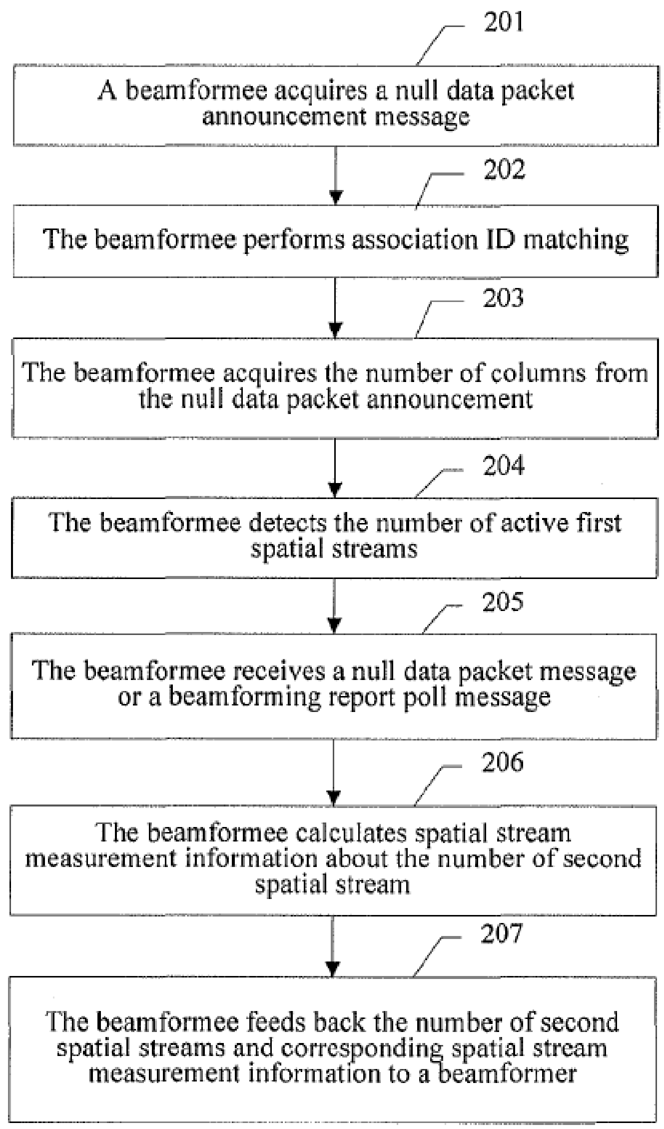


FIG. 2

1926. Yao. Fig. 2. As I explained above, the above figure describes steps taken by a beamformee after receiving an NDPA frame. The NDPA includes a number of fields, including the number of columns and STA Info fields. Yao at [0032], [0036], [0042], [0043]. The number of columns is indicated by adding 1 the Nc Index field set by the beamformer in the NDPA and indicate the number of spatial streams that a STA needs to feed back. Yao at [0027]. Within the STA Info filed is the Feedback Type subfield which indicates whether the transmission is SU-MIMO (when the Feedback Type is 0) or MU-

[redacted]

MIMO (when the Feedback Type is 1). Yao at [0042]-[0043]. Also in the STA Info field is the Association ID (AID) subfield which identifies the station assigned to the STA Info field. Yao at [0042].

1927. According to Yao, after receiving the NDPA, the beamformee "performs association ID matching." Yao [0044]. In this step, the beamformee "extracts [the] STA Info fields sequentially from the NDPA message and compares the AIDs [(association IDs)] of the STA Info field one by one with the locally stored AID" of the beamformee. Yao [0045]. If the station identifies a match between its AID and the AID in the STA Info field, the STA understands that "the NDPA message needs to be locally received." Yao at [0045]. Next, the station reads the number of columns and Feedback Type from the NDPA. Yao at [0046]-[0047]. Finally, the station detects the number of active spatial streams. Yao at [0048].

1928. Next, "The beamformee receives a null data packet message or a beamforming report poll message." Yao [0050]. In the case of the NDP, the beamformee checks whether the AID in the NDP matches its AID, and if so, sends its feedback in response. Yao [0051]. In the case of receiving a beamforming report poll, the beamformee simply detects whether it has received the poll, and if so, sends tis feedback. Yao [0053].

1929. According to this process, Yao explains that feedback is sent when a station identifies its AID in a downlink frame (either an NDP or beamforming report poll). Yao never describes determining the cardinality of the number of station information fields. Moreover, as explained above, Yao never discloses determining the total number of station information fields.

1930. To the extent Dr. Hansen suggests that "extraction of the number of columns" teaches determining the number of Station Info fields, he is mischaracterizing. Yao. "the number of columns is a field set by the beamformer in the NDPA message and is used to indicate the number of spatial streams that a STA needs to feed back." 0062. As Yao explains, "In the prior art, to prevent abnormal situations, IEEE802.11ac specifies that the

[redacted]

number of actual active antennas of the beamformee must be larger than or equal to the number of columns (NC) set by the beamformer in a null data packet announcement (NDPA, Null data packet Announcement) message." 0004

1931. This is illustrated in Figure 8-29I from 802.11ac (which Dr. Hansen relies on in his report as Ex. 919-6). Ex. 919-6 at 44-45:

	B0 B11	B12	B13 B15
	AID12	Feedback Type	Nc Index
Bits:	12	1	3

Figure 8-29I—STA Info field

Figure 8-29I illustrates that STA Info field within the NDPA. This field includes the three subfields discussed in Yao: AID, Feedback Type, and Nc Index. Table 8-18a explains that the "Nc Index indicates the number of columns, *Nc*, in the Compressed Beamforming Matric subfield minus 1:"

Table 8-18a—STA Info subfields

Field	Description
AID12	Contains the 12 least significant bits of the AID of a STA expected to process the following VHT NDP and prepare the sounding feedback. Equal to 0 if the STA is an AP, mesh STA, or STA that is a member of an IBSS.
Feedback Type	Indicates the type of feedback requested. Set to 0 for SU. Set to 1 for MU.
Nc Index	If the Feedback Type field indicates MU, then Nc Index indicates the number of columns, *Nc*, in the Compressed Beamforming Feedback Matrix subfield minus 1: Set to 0 to request *Nc* = 1 Set to 1 to request *Nc* = 2 … Set to 7 to request *Nc* = 8 Reserved if the Feedback Type field indicates SU.

Ex. 919-6 at 44-45. In other words, the "number of columns" described by Yao has nothing to do with the number of station information fields.

1932. For these reasons, it is my opinion that Yang does not render teach or suggest these claim limitations.

[redacted]

14.6.5.2 Yao Does Not Disclose Or Render Obvious That Feedback Is Transmitted Or Received "[In Response To Determining That The/When A] Number Of The One Or More Station Information Fields In The NDPA Is One" ([1.D], [11.C])

1933. Independent claim [1.D] of the '919 Patent recites "***in response to determining that the number of the one or more station information fields in the NDPA is one***, transmitting first Channel State Information (CSI) feedback in response to receiving the NDP." '919 Patent at 33:4-7 (emphasis added). While independent claim [11.C] does not state that feedback should be sent "in response to" the determination, it recites something similar: "***when a number of the one or more station information fields in the NDPA is one***, receiving first Channel State Information (CSI) feedback transmitted in response to the NDP[A] having only one station information field." *Id.*, 34:5-9 (emphasis added).

1934. As an initial matter, I note that Claim [11.C] appears to included a typographical error that suggested the NDP, rather than the NDPA discussed elsewhere, had station information fields. *Id.* at 162, 164 (compare claim 1 with claim 11). I discuss this issue below in section 16.2 and incorporate that discussion here.

1935. Dr. Hansen points to Yao's discussion of the NDPA and the feedback mechanism described by Yao. Hansen Report ¶¶3783-3784 (citing Yao [0027], [0038]-[0043]). Dr. Hansen also points to Yao's discussion of the information contained in Yao's NDPA frame. Hansen Report ¶¶3785-3790 (citing Yao [0045], [0047], [0051], [0062], [0087]-[0089], [0094]-[0095]). But Yao does not teach or suggest these limitations, as described below.

1936. These sections of Yao focus largely on Yao's figure 2 and related discussion:

[redacted]

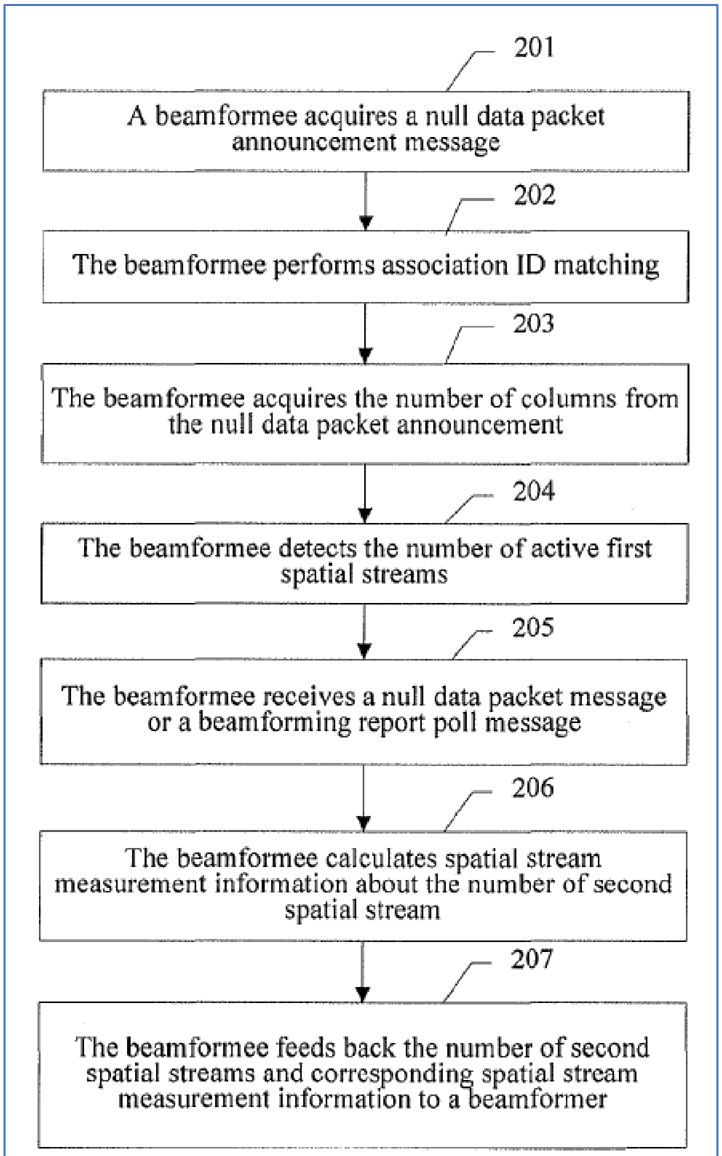


FIG. 2

1937. Yao. Fig. 2. As I explained above, the above figure describes steps taken by a beamformee after receiving an NDPA frame. The NDPA includes a number of fields, including the number of columns and STA Info fields. Yao at [0032], [0036], [0042], [0043]. The number of columns is indicated by adding 1 to the Nc Index field set by the beamformer in the NDPA and indicate the number of spatial streams that a STA needs to feed back. Yao at [0027]. Within the STA Info filed is the Feedback Type subfield which indicates whether the transmission is SU-MIMO (when the Feedback Type is 0) or MU-

[redacted]

MIMO (when the Feedback Type is 1). Yao at [0042]-[0043]. Also in the STA Info field is the Association ID (AID) subfield which identifies the station assigned to the STA Info field. Yao at [0042].

1938. According to Yao, after receiving the NDPA, the beamformee "performs association ID matching." Yao [0044]. In this step, the beamformee "extracts [the] STA Info fields sequentially from the NDPA message and compares the AIDs [(association IDs)] of the STA Info field one by one with the locally stored AID" of the beamformee. Yao [0045]. If the station identifies a match between its AID and the AID in the STA Info field, the STA understands that "the NDPA message needs to be locally received." Yao at [0045]. Next, the station reads the number of columns and Feedback Type from the NDPA. Yao at [0046]-[0047]. Finally, the station detects the number of active spatial streams. Yao at [0048].

1939. Next, "The beamformee receives a null data packet message or a beamforming report poll message." Yao [0050]. In the case of the NDP, the beamformee checks whether the AID in the NDP matches its AID, and if so, sends its feedback in response. Yao [0051]. In the case of receiving a beamforming report poll, the beamformee simply detects whether it has received the poll, and if so, sends tis feedback. Yao [0053].

1940. According to this process, Yao explains that feedback is sent when a station identifies its AID in a downlink frame (either an NDP or beamforming report poll). Yao never describes sending feedback in response to the number of station information fields. Moreover, as explained above, Yao never discloses determining the total number of station information fields.

1941. For these reasons, it is my opinion that Yang does not render obvious these claim limitations.

[redacted]

14.6.5.3 Yao Does Not Render Obvious "when the number of the one or more station information fields in the NDPA is greater than one: [receiving/transmitting] a first trigger frame; and [transmitting/receiving] the first CSI feedback in response to [receiving/transmitting] the first trigger frame" (2, 12)

1942. Claim 2 of the '919 Patent recites "***when the number of the one or more station information fields in the NDPA is greater than one***: receiving a first trigger frame; and transmitting the first CSI feedback in response to receiving the first trigger frame." '919 Patent at 33:12-17 (emphasis added). Claim 12 recites something similar: "***when the number of the one or more station information fields in the NDPA is greater than one***: transmitting a first trigger frame; and receiving the first CSI feedback in response to transmitting the first trigger frame." *Id.*, 34:12-17 (emphasis added).

1943. Dr. Hansen points to Yao's discussion of Figure 4 and the Beamforming Report Poll for this element. Hansen Report at ¶¶3901-3909. Figure 4 of Yao illustrates a feedback method similar to the one described by 802.11ac:

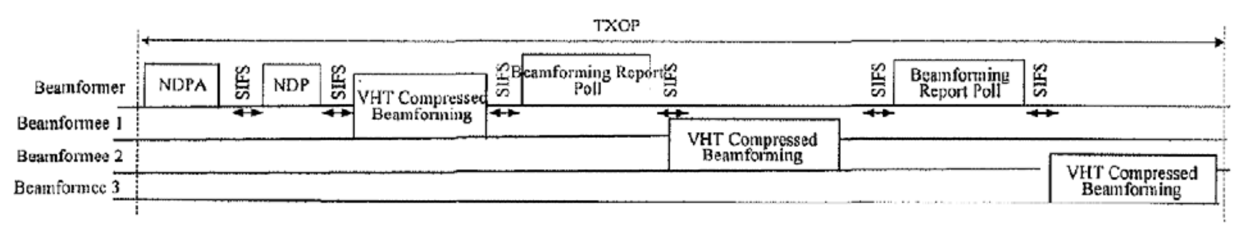


FIG. 4

Yao at Fig. 4. As with 802.11ac, this technique illustrates feedback sent from several stations to an access point. As with single user sounding, feedback is sent by the first station immediately after the NDP. Subsequent stations are sent in single user transmissions following a Beamforming Report Poll.

1944. None of this discussion describes transmitting or receiving a trigger frame when the number of station information fields in the NDPA is greater than one. This is illustrated by the first station in Yao's figure 4 sounding method. In that case, the first station sends its feedback without awaiting a polling frame. Because there is no difference in the action

[redacted]

of station one when there is one station information field or more than one station information field in the NDPA, Yao cannot disclose receiving or transmitting a trigger frame when there is more than one station information field.

1945. For these reasons, it is my opinion that Yao does not render obvious these claim limitations.

14.6.5.4 Yao Does Not Render Obvious "[transmitting/receiving] the first CSI feedback in a multi user transmission in response to receiving the first trigger frame." (5, 16)

1946. Claims 5 and 16 of the '919 Patent require either transmitting or receiving a trigger frame and then receiving or transmitting CSI feedback when the number of station information fields in the NDPA is greater than one. '919 at 33:26-30, 34:32-36.

1947. Dr. Hansen cites evidence that he asserts proves Yao discloses these limitations. Hansen Report at ¶¶4022-4024 (5), ¶4320-4321 (16). But Yao does not teach or suggest these limitations.

1948. Dr. Hansen rely on Yao's discussion of the sequential feedback technique illustrated in Yao's figure 4. Hansen Report at ¶4022-4023. But, none of this discussion describes multi user transmission in anyway.

1949. Figure 4 of Yao illustrates a feedback method similar to the one described by 802.11ac:

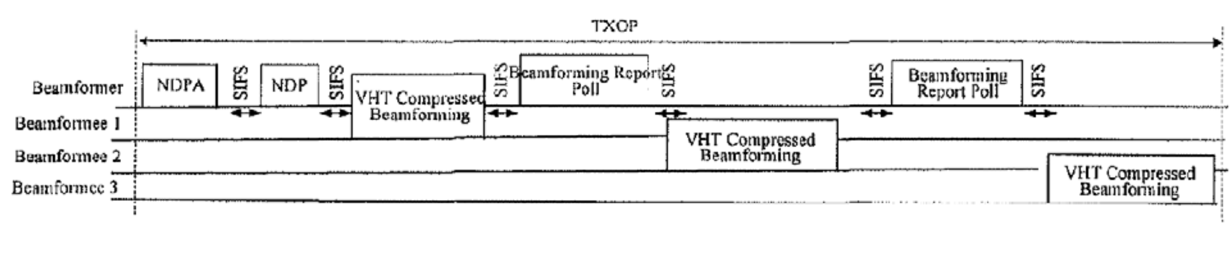


FIG. 4

Yao at Fig. 4. As with 802.11ac, this technique illustrates feedback sent from several stations to an access point. As with single user sounding, feedback is sent by the first station immediately

[redacted]

after the NDP. Subsequent stations are sent in single user transmissions following a Beamforming Report Poll.

1950. Unlike the ’919 Patent, Yao describes that even in the case of multiple stations, feedback is sent in sequential frames. Each of these frames after the first is initiated by a Beamforming Report Poll. Dr. Hansen does not identify anything in his report that supports the conclusion that Yao teaches or suggests multi-user feedback.

1951. For these reasons, it is my opinion that Yao does not teach or suggest these claim limitations.

14.6.5.5 Yao does not disclose or render obvious claims 8 and 9

1952. Dr. Hansen does not contend Yao discloses these elements. *See* Hansen Report at ¶¶4127-4180.

14.6.6 Ghosh Fails To Disclose Or Render Obvious Several ‘919 Claim Limitations

14.6.6.1 Ghosh Does Not Disclose Or Render Obvious That Feedback Is Transmitted Or Received “[In Response To Determining That The/When A] Number Of The One Or More Station Information Fields In The NDPA Is One” ([1D], [11C])

1953. Independent claim [1.D] of the ’919 Patent recites “***in response to determining that the number of the one or more station information fields in the NDPA is one***, transmitting first Channel State Information (CSI) feedback in response to receiving the NDP.” ’919 Patent at 33:4-7 (emphasis added). While independent claim [11.C] does not state that feedback should be sent “in response to” the determination, it recites something similar: “***when a number of the one or more station information fields in the NDPA is one***, receiving first Channel State Information (CSI) feedback transmitted in response to the NDP[A] having only one station information field.” *Id.*, 34:5-9 (emphasis added).

1954. As an initial matter, I note that Claim [11.C] appears to included a typographical error that suggested the NDP, rather than the NDPA discussed elsewhere, had station information fields. *Id.* at 162, 164 (compare claim 1 with claim 11). I discuss this issue below in section 16.2 and incorporate that discussion here.

[redacted]

1955. Dr. Hansen points to Ghosh's sounding method described by figures 3 and 7. Hansen Report ¶3793-3799. Ghosh does not teach or describe these elements. As I explained above, Ghosh's method of sounding in a multi-station wireless network is illustrated by Figure 3:

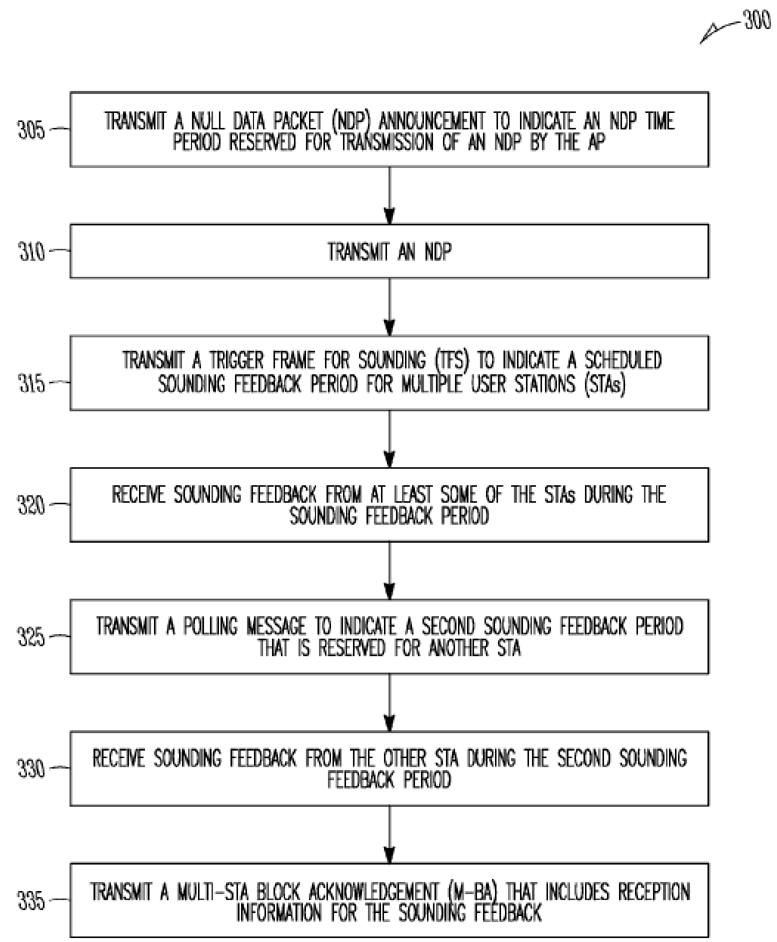


FIG. 3

Ghosh at Fig. 3. Figure 7 describes a similar method from the perspective of the receiving device. In this method, the AP first transmits an NDPA followed by an NDP. *Id.* at steps 305-310. Following the NDP, the AP transmits a trigger frame with feedback scheduling information for any responding stations. *Id.* at step 315. After the stations respond accordingly, the AP sends a multi-station block acknowledgement to the stations and may send subsequent polling messages to receive feedback from separate subsets of the stations. *Id.* at step 335.

[redacted]

1956. However, Dr. Hansen has not identified any disclosure in Ghosh that suggests the determining a number of station information fields or taking any action in response to that determination.

1957. For these reasons, it is my opinion that Ghosh does not teach or suggest these claim limitations.

14.6.6.2 Ghosh Does Not Disclose Or Render Obvious "[transmitting/receiving] first Channel State Information (CSI) feedback in response to [receiving/transmitting] the NDP" (1D, 11C)

1958. Independent claim 1D of the '919 Patent recites "transmitting first Channel State Information (CSI) feedback in response to receiving the NDP." '919 Patent at 33:4-7. Independent claim 11C recites something similar: "receiving first Channel State Information (CSI) feedback transmitted in response to the NDP having only one station information field." '919 Patent at 34:5-7.

1959. Dr. Hansen cites evidence that he asserts proves Ghosh discloses these limitations. Hansen Report at ¶¶3792-3805 (1D), ¶¶4229-4230 (11C). But Ghosh does not teach or suggest these limitations, as described below.

1960. As I explained above, in the techniques described by Ghosh, the AP first transmits an NDPA followed by an NDP. Ghosh at steps 305-310. Following the NDP, the AP transmits a trigger frame with feedback scheduling information for any responding stations. *Id.* at step 315. After the stations respond accordingly, the AP sends a multi-station block acknowledgement to the stations and may send subsequent polling messages to receive feedback from separate subsets of the stations. *Id.* at step 335.

1961. However, nothing Dr. Hansen points to in Ghosh suggests sending or receiving feedback information in the absence of a trigger frame.

[redacted]

14.6.6.3 Ghosh Does Not Disclose Or Render Obvious "Wherein [Transmitting/Receiving] The First CDI Feedback In Response To Receiving The NDP Comprises: [Transmitting/Receiving] The First CSI Feedback In A Single User Transmission In Response To [Transmitting/Receiving] The NDP" (4, 15)

1962. Dependent claim 4 claims "The method of claim 2, wherein transmitting the first CSI feedback in response to receiving the NDP comprises: transmitting the first CSI feedback in a single user transmission in response to receiving the NDP." Similarly, dependent claim 15 claims "The method of claim 13, wherein receiving the first CSI feedback in response to transmitting the first trigger frame comprises: receiving the first CSI feedback a second predetermined IFS after transmitting the first trigger frame."

1963. However, each discussion identified by Dr. Hansen discusses only multi-user feedback. For example, Dr. Hansen quotes Ghosh as "The NDP-A 410 may be transmitted by the AP 102, and may be received by **the STAs I 03 labeled as STA #1, STA #2, and STA #3**," and "one of the TFS may poll a **subset of the set of STAs I 03** for transmission." None of these discussions teach or suggest single user feedback as claimed in the '919 patent.

1964. Moreover, Dr. Hansen has provided no reasoning to suggest modifying Ghosh to include single user feedback.

1965. For these reasons, it is my opinion that Ghosh does not render obvious these limitations.

14.6.7 Yang Fails To Disclose Or Render Obvious Several '919 Claim Limitations

14.6.7.1 Yang Does Not Disclose Or Render Obvious That Feedback Is Transmitted Or Received "[In Response To Determining That The/When A] Number Of The One Or More Station Information Fields In The NDPA Is One" ([1.D], [11.C])

1966. Independent claim [1.D] of the '919 Patent recites "***in response to determining that the number of the one or more station information fields in the NDPA is one***, transmitting first Channel State Information (CSI) feedback in response to receiving the NDP." '919 Patent at 33:4-7 (emphasis added). While independent claim [11.C] does not state that

[redacted]

feedback should be sent "in response to" the determination, it recites something similar: "***when a number of the one or more station information fields in the NDPA is one***, receiving first Channel State Information (CSI) feedback transmitted in response to the NDP[A] having only one station information field." *Id.*, 34:5-9 (emphasis added).

1967. As an initial matter, I note that Claim [11.C] appears to included a typographical error that suggested the NDP, rather than the NDPA discussed elsewhere, had station information fields. *Id.* at 162, 164 (compare claim 1 with claim 11). I discuss this issue below in section 16.2 and incorporate that discussion here.

1968. As I note above, Dr. Hansen relies on an unreliable machine translation of Yang to cite evidence that he asserts proves Yang discloses these limitations. Hansen Report at ¶¶3806-3818 (1D), 4231-4232 (11C) (incorporating discussion of element 1D). But Yang does not teach or suggest these limitations, as described below.

1969. Dr. Hansen cites various passages from Yang that appear to discuss channel sounding and the contents of the NDPA. However, the text Dr. Hansen quotes in his report is not the text found in the google translation he purportedly relies on. For example, in paragraph 3807, Dr. Hanse quotes Yang as:

> In a wireless communications system, with the application of a multiple-input and multiple-output (MIMO) technology and a beamforming technology, channel information becomes more and more important. A beamformer obtains channel information by receiving feedback from a beamformee, and uses the channel information as a reference for subsequent data sending. The beamformer obtains a transmit opportunity (TXOP) through contention before each data transmission, and then transmits data within a time length corresponding to the TXOP.

Hansen Report ¶3807 (citing "Yang, [0002]"). However, Ex. 919-8, the translation that Dr. Hansen purports to rely on states at what appears to be paragraph [0002]:

> In wireless communication system, because MIMO (Multiple-Input Multiple-Output, multiple-input and multiple-output) technology and beamforming (beam shaping) The Application of Technology, it is more and more important that channel information becomes. Beam-shaper (beamformer) obtains channel information through the feedback of received beam receiver (beamformee), and as the reference of follow-up transmission data. Beam-shaper all obtained TXOP (Transmit opportunity, transmission opportunity) with the mode of competition

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> before each transfer of data, in this TXOP time corresponding length, transmit data then.

Yang at 2 (errors in original).

1970. These errors become more problematic when Dr. Hansen applies them to the claims of the '919 Patent. It appears Dr. Hansen has selectively re-interpreted Yang to appear to teach this claim limitation, when the translated text does not support this conclusion. For example, Dr. Hansen quotes Yang as teaching that the NDPA includes "the number of stations and station list information, and the number of stations is used to indicate to number of receive ends in the station list information." However, the Yang translation actually explains that the "NDPA comprises website number and site list information, and wherein said website number is used for indicating said site list information receiving terminal number." Instead of teaching that the number of stations indicates that total number of station in the station list information, Yang actually explains that the number tells the receiving end which number they are in the station list information. For example, Yang seems to explain that the "website number" would inform the station that it is the second station in the list information, rather than that there are seven stations receiving the NDPA. Errors like this continue throughout Dr. Hansen's analysis of Yang. *Compare, e.g.,* Hansen Report ¶¶3813-3814 with Yang (Ex. 919-9) at 3.

1971. Reviewing the translation provided by Dr. Hansen, it is clear that Yang does not disclose taking any action in response to determining that the number station information fields is one. Instead, Yang explains that the "website number" is use to indicate which station should send feedback in response to the NDPA. Yang at 3 ("the website number[] is used to indicate the entrained STA that needs feedback channel information of this NDPA."), ("said NDPA comprises website number and site list information, wherein said website number is used for indicating said site list information receiving terminal number"). Yang also explains that stations receiving the NDPA do not read every site information. Yang explains that in step 303, the receiving terminal reads the site list

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information and stop reading the site list when the receiving device reaches the station list corresponding to the "website number:

> S303, said receiving terminal read the information in the said site list information successively, determine whether to comprise the information corresponding with said receiving terminal, and definite said site list information reads and finishes if the number of times that said receiving terminal reads surpasses said website number

1972. *Id.* ("If read the relevant information that oneself is arranged in the tabulation, promptly know and oneself in tabulation, no longer continue to read remaining information in the tabulation.").

1973. Thus, Yang never discloses taking any action in response to determining the total number of station information frames. Even under Dr. Hansen's interpretation, Wang's NDPA only tells the stations the number of "station lists" in the NDPA, but does not describe sending or receiving feedback in response to that number.

1974. For these reasons, it is my opinion that Yang does not teach or suggests these claim limitations.

14.6.7.2 Yang Does Not Disclose "when the number of the one or more station information fields in the NDPA is greater than one: [receiving/transmitting] a first trigger frame; and [transmitting/receiving] the first CSI feedback in response to [receiving/transmitting] the first trigger frame" (2, 12)

1975. Claims 2 and 12 of the '919 Patent require either transmitting or receiving a trigger frame and then receiving or transmitting CSI feedback when the number of station information fields in the NDPA is greater than one. '919 at 33:12-17, 34:12-16.

1976. Dr. Hansen cites evidence that he asserts proves Yang discloses these limitations. Hansen Report at ¶¶3993-3998 (2), ¶4260-4261 (12). But Yang does not teach or suggest these limitations.

1977. Dr. Hansen appears to rely on Yang's discussion of instructing stations to provide feedback to an access point. But, none of this discussion describes trigger frames in anyway.

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1978. For these reasons, it is my opinion that Yang does not teach or suggest these claim limitations.

14.6.7.3 Yang Does Not Disclose "[transmitting/receiving] the first CSI feedback in a multi user transmission in response to receiving the first trigger frame." (5, 16)

1979. Claims 5 and 16 of the '919 Patent require either transmitting or receiving a trigger frame and then receiving or transmitting CSI feedback when the number of station information fields in the NDPA is greater than one. '919 at 33:26-30, 34:32-36.

1980. Dr. Hansen cites evidence that he asserts proves Yang discloses these limitations. Hansen Report at ¶¶4034-4039 (2), ¶4320-4321 (12). But Yang does not teach or suggest these limitations.

1981. Dr. Hansen appears to rely on Yang's discussion of instructing stations to provide feedback to an access point. But, none of this discussion describes multi user transmission in anyway.

1982. For these reasons, it is my opinion that Yang does not teach or suggest these claim limitations.

14.6.8 A POSITA would not have combined Merlin '051, 802.11ac-2013, 802.11-15/1097r1, Chun, Yao, Ghosh and/or Yang

1983. Dr. Hansen alleges that a POSITA would have been motivated to make any combination of Merlin '051, 802.11ac-2013, 802.1-15/1097r1, Chun, Yao, Ghosh or Yang. Hansen Report at ¶¶4375-4391. I disagree. Even assuming arguendo that my above analysis is incorrect and there is some combination of Merlin '051, 802.11ac-2013, 802.1-15/1097r1, Chun, Yao, Ghosh and/or Yang that discloses every limitation of the '919 claims, a POSITA would not have combined those references (or any subset thereof).

1984. There is no apparent reason—apart from improper hindsight—that would have motivated a POSITA to combine together Merlin '051, 802.11ac-2013, 802.1-15/1097r1, Chun, Yao, Ghosh or Yang. Merlin '051 is a Qualcomm patent application filed in February 2016 that was primarily invented by Simone Merlin. Merlin '051 at title page.

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802.11ac-2013 is an IEEE standard that began in September 2008 and included contributions from hundreds of disparate individuals. https://standards.ieee.org/ieee/802.11ac/4473/; TPL0001609-1612. 802.1-15/1097r1 is an 802.11ax task group slide comparing sounding procedures submitted by employees of Toshiba corporation. 802.1-15/1097r1 at 1, 11, 12. Chun is an LG Electronics patent filed August 2016 that was primarily invented by Jinyoung Chun. Chun at title page. Yao is a Huawei patent application filed April 24, 2013 that was primarily invented by Zongming Yao. Yao at title page. Ghosh is an Intel patent filed June 2015 that was primarily inventions by Chittabrata Ghosh. Ghosh at title page. And Yang is a Huawei Chinese patent application purportedly filed in June 2011. As shown above, these seven references originate from different entities (apart from Yao and Tang), were drafted at different times, and have different inventors. Dr. Hansen provides no apparent reason why these references would be combined.

1985. Dr. Hansen's motivation to combine analysis is superficial. First, Dr. Hansen simply attempts to show that each of his seven '919 references are "analogous art" because, like the '919 Patent, each of those references "relates to WLAN operation at least according to IEEE 802.11 standards." Hansen Report at ¶4376. Just because references relate to 802.11 standards does not mean a POSITA would have combined them. A search of the USPTO patent database reveals there are 407,330 patents that mention "802.11."

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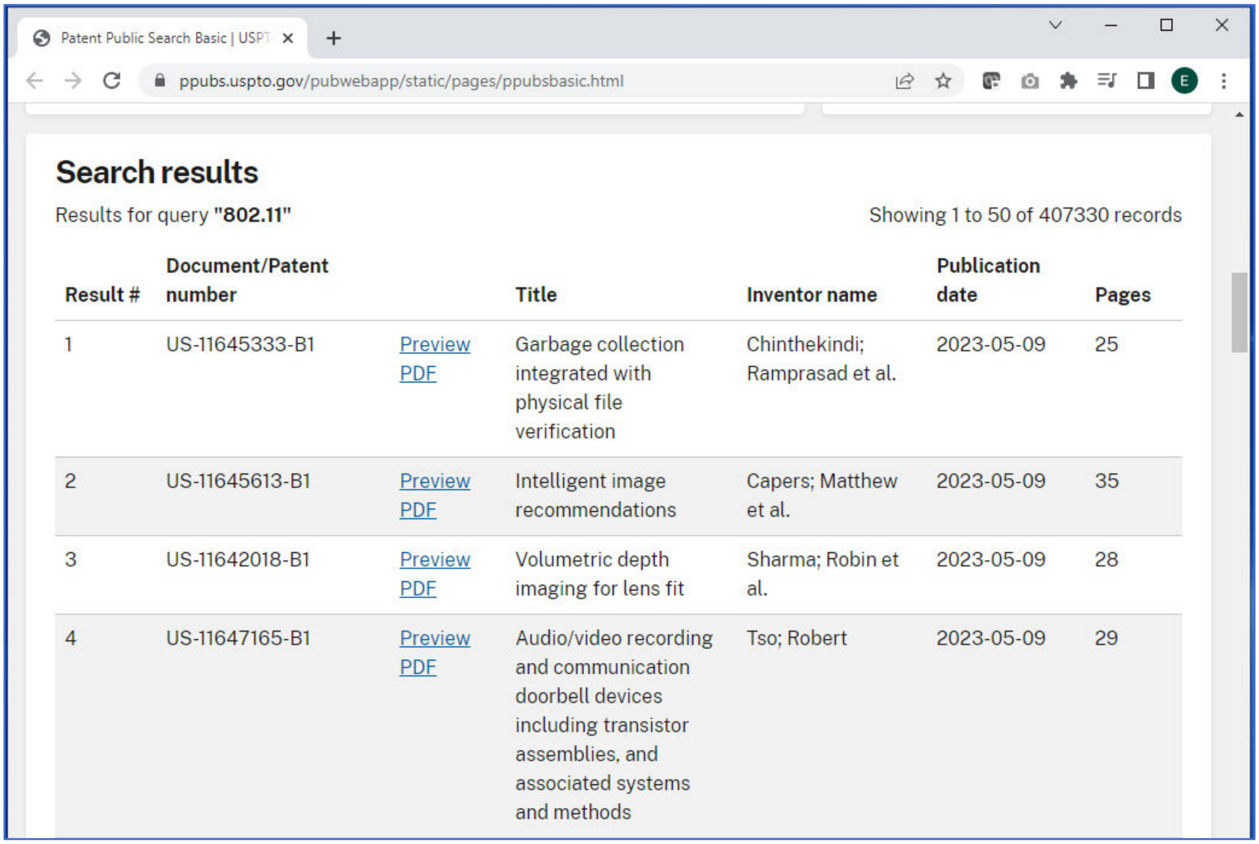

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ppubs.uspto.gov/pubwebapp/static/pages/ppubsbasic.html

Search results

Results for query **"802.11"**

Showing 1 to 50 of 407330 records

Result #	Document/Patent number		Title	Inventor name	Publication date	Pages
1	US-11645333-B1	Preview PDF	Garbage collection integrated with physical file verification	Chinthekindi; Ramprasad et al.	2023-05-09	25
2	US-11645613-B1	Preview PDF	Intelligent image recommendations	Capers; Matthew et al.	2023-05-09	35
3	US-11642018-B1	Preview PDF	Volumetric depth imaging for lens fit	Sharma; Robin et al.	2023-05-09	28
4	US-11647165-B1	Preview PDF	Audio/video recording and communication doorbell devices including transistor assemblies, and associated systems and methods	Tso; Robert	2023-05-09	29

https://ppubs.uspto.gov/pubwebapp/static/pages/ppubsbasic.html. By Dr. Hansen's logic, a POSITA would be motivated to make any combination of these 407,330 references. Yet Dr. Hansen fails to show why a POSITA would be motivated to make the particular five-reference combination that he selects. Instead, it appears Dr. Hansen cherry-picked just five of the many references that mention 802.11. This approach uses improper hindsight.

1986. Next, Dr. Hansen argues that each reference is "reasonably pertinent to the problem faced by the ['919 inventor]" so they "would have logically commended themselves to the inventor's attention in considering the problem they were attempting to address." Hansen Report at ¶4377. But Dr. Hansen never identifies what he believes the problem faced by the '919 inventor to be. *Id.*

1987. The '919 Patent explains that prior 802.11 standards like 802.11ac were insufficient and "WLAN users demand improved performance in delivering their applications, including improved power consumption for battery-operated devices." '919 at 1:35-37.

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Accordingly, the '919 Patent explains that its genesis comes from "an amendment focused on providing a High Efficiency (HE) WLAN in high-density scenarios is being developed by the IEEE 802.llax task group." *Id.* at 1:48-50. That 802.11ax "amendment focuses on improving metrics that reflect user experience, such as average per station throughput, the 5th percentile of per station throughput of a group of stations, and area throughput." *Id.* at 1:51-54. And a specific problem addressed by the '919 Patent is that, prior to the '919 Patent, "sounding operations may contribute to the total amount of overhead in a wireless network." *Id.* at 2:12-13. Accordingly, the '919 patent sought to create more efficient sounding procedures. *Id.* at 2:14-16.

1988. Next, Dr. Hansen goes reference-by-reference and argues that each "discloses teaching, suggestions, and motivations **to use the disclosed system**." Hansen Report at ¶¶4378-4384 (emphasis added). But it is immaterial whether each of Dr. Hansen's references individually teach, suggest, and motivate a POSITA to use the system disclosed by that individual reference. What matters is whether a POSITA would be motivated **to combine references**. Dr. Hansen's analysis is irrelevant to the obviousness issues.

1989. Next, Dr. Hansen parrots various legal mantras related to obvious: "predictable results," "simple substitution," "reasonable expectation of success" "finite number of identified, predictable solutions," and "design incentives or other market forces." Hansen Report at ¶4385. But he provides no analysis. What are the predictable results? What are the simple substitutions? Why is there a reasonable expectation of success? What are the finite number of identified, predictable solutions? What are the design incentives or other market forces? Dr. Hansen never explains. *Id.* This superficial analysis does not meet his burden.

1990. Finally, Dr. Hansen identifies five specific combinations that he alleges render the '919 claims obvious.

1991. First, Dr. Hansen specifically alleges that it would be obvious to combine Merlin '051 with 802.11ac-2013. Hansen Report at ¶4386. Yet, Dr. Hansen never explains how

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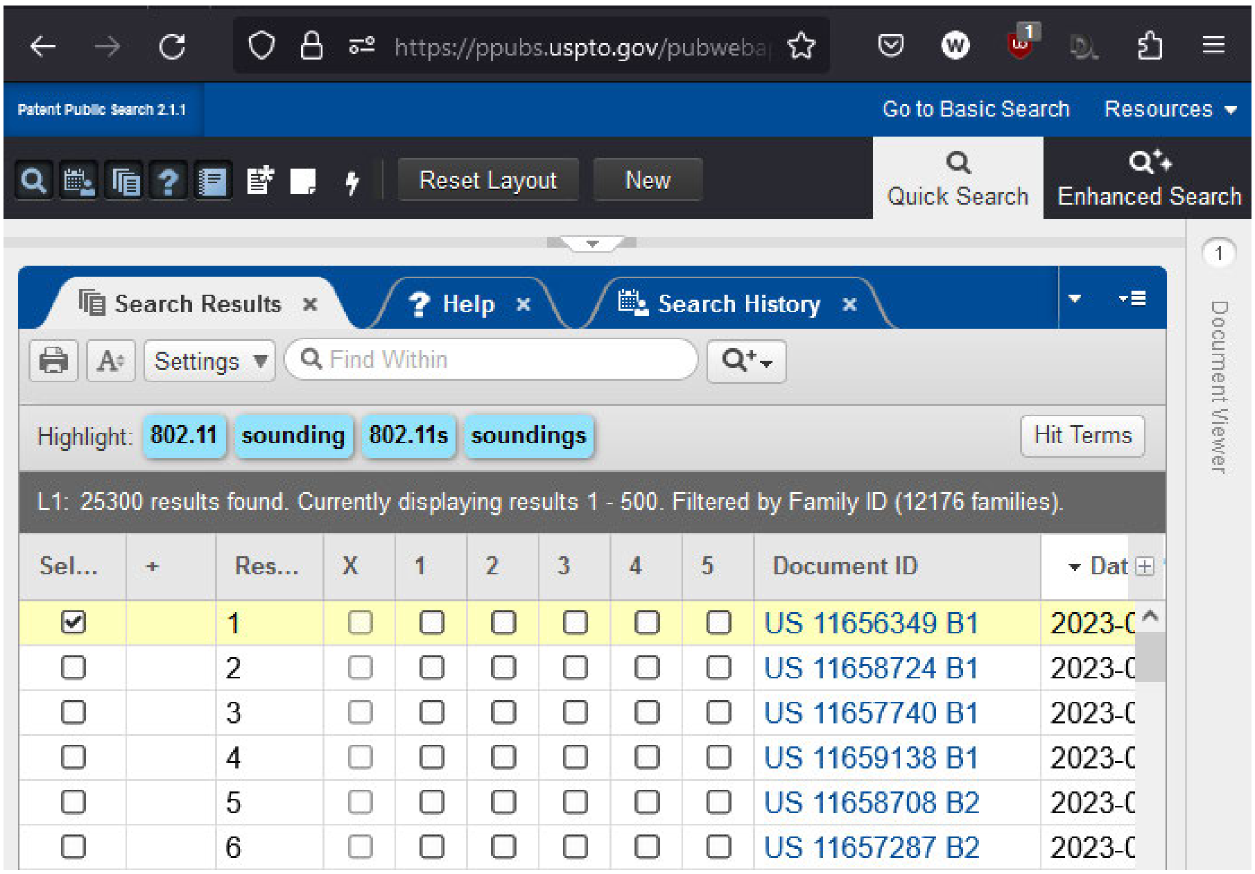
he would modify Merlin ’051 to incorporate the teaching of 802.11ac. Instead, he merely copy-pastes large passages from Merlin with no analysis whatsoever. Accordingly, Dr. Hansen has failed to properly explain this obviousness combination. Further, Dr. Hansen’s sole motivation for making this combination is that Merlin “provides teachings, suggestions, and motivation to use the invention in the context of IEEE 802.11 wireless protocols such as 802.11ac-2013.” *Id.* That is insufficient. Indeed, there are 25,300 patents that relate to both “802.11” and “sounding,” and Dr. Hansen offers no apparent reason to pick this combination—apart from improper hindsight:



1992. https://ppubs.uspto.gov/pubwebapp/static/pages/ppubsbasic.html. But even if this combination were made, it would still not meet all the limitations of the ‘919 claims. As shown above, even the combination of these references fails to teach or suggest numerous

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'919 claim limitations. Consequently, even this combination still fails to invalidate the '919 claims.

1993. Second, Dr. Hansen specifically alleges that it would be obvious to combine Merlin '051 and 802.11ac-2013 with 802.11-15/1097r1. Hansen Report at ¶4387. But, as with the above, Dr. Hansen never explains how he would modify Merlin '051 or 802.11ac to incorporate the teaching of 802.11-15/1097r1. Instead, he merely copy-pastes large passages from 802.11-15/1097r1 with little analysis. Accordingly, Dr. Hansen has failed to properly explain this obviousness combination. Also as shown above, even the combination of these references fails to teach or suggest numerous '919 claim limitations. Consequently, even this combination still fails to invalidate the '919 claims.

1994. Third, Dr. Hansen alleges that it would be obvious to combine Chun with Ghosh and/or Yang. Hansen Report ¶4388. But, as with the above, Dr. Hansen never explains how he would modify Chun to incorporate the teachings of Ghosh or Yang. Instead, he copy-pastes large sections of these references with no analysis of how they would be combined. Moreover, Dr. Hansen has not shown that Chun is prior art. Accordingly, Dr. Hansen has failed to properly explain this obviousness combination. Also as shown above, even the combination of these references fails to teach or suggest numerous '919 claim limitations. Consequently, even this combination still fails to invalidate the '919 claims.

1995. Fourth, Dr. Hansen alleges that it would be obvious to combine Merlin with any of his other '919 references. Hansen Report ¶4389. But, as with the above, Dr. Hansen never explains how he would modify Merlin to incorporate the teachings of any other reference. For the same reasons I explained above with respect to the first combination, Dr. Hansen has failed to properly explain this obviousness combination. As shown above, even the

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combination of these references fails to teach or suggest numerous '919 claim limitations. Consequently, even this combination still fails to invalidate the '919 claims.

1996. Fifth, Dr. Hansen alleges that it would be obvious to combine Merlin, 802.11ac, or 802.11-15/1097r1 with one of Yang or Yao. Hanse Report ¶ 4390-4391. Dr. Hansen's proposed combination fails at least because Merlin and 802.11-15/1097r1 and Yang are not prior art. But, as with his combination discussed above, Dr. Hansen's sole motivation for making this combination is that the references "relate[] to WLAN operation at least according to IEE 802.11 standards…." *Id.* That is insufficient. Indeed, there are 25,300 patents that relate to both "802.11" and "sounding," and Dr. Hansen offers no apparent reason to pick this combination—apart from improper hindsight. Moreover even if this combination were acceptable, Dr. Hansen tacitly acknowledges that none of these references disclose determining exactly a number of station information field, or acting in based on that number. *See id.* at ¶ 4390 (only contending that Yao and Yang describe determining that the number of station information fields is one or more). As shown above, even the combination of these references fails to teach or suggest numerous '919 claim limitations. Consequently, even this combination still fails to invalidate the '919 claims.

15. THE SECONDARY CONSIDERATIONS SHOW NON-OBVIOUSNESS

1997. Dr. Hansen opines that the secondary considerations do not support the non-obviousness of any Asserted Claim. Hansen Report at ¶4871. I disagree; as explained below, the secondary considerations provide objective evidence that the Asserted Claims are not obvious. Even assuming the asserted art addressed by Dr. Hansen supported obviousness—and they do not for the reasons given above—the secondary considerations evidence compels a conclusion of non-obviousness.